

**An exploration of pre-service Geography teachers' understanding and learning of
Environmental Education at a University in Zimbabwe**

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**A thesis submitted in fulfilment of the academic requirements for the degree of Doctor
of Philosophy in Education in Environmental Education, School of Education, and
University of KwaZulu-Natal**

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January 2019

DECLARATION

I, Daniel Gamira (213574367) declare that:

- (i) The research reported in this thesis, except where otherwise indicated, is my original work.
- (ii) This thesis has not been submitted for any degree or examination at any university.
- (iii) This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
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 - a) The words have been re-written but the general information attributed to the author(s) has been acknowledged; and
 - b) Where the exact words have been used, they have been placed within quotation marks, and referenced.
- (v) The work described in this thesis was carried out in the School of Education, University of KwaZulu-Natal, from February 2014 to April 2018 under the supervision of Dr Asheena Singh-Pillay (Supervisor) and Dr Ronicka Mudaly (Co-Supervisor).
- (vi) Ethical clearance No. HSS/ 1261/015D was granted prior to undertaking the fieldwork.

As the candidate's supervisor I, Dr Asheena Singh-Pillay, agree to the submission of this thesis.

Signed: A. Singh-Pillay_____ Date: 6-3-19__

As the candidate's co-supervisor I, Dr Ronicka Mudaly, agree to the submission of this thesis.

Signed: R. Mudaly_____ Date: 6-3-19_____

DEDICATION

This thesis is dedicated to my late mother, who gave me my work ethic, Mbuya Agomo.

ACKNOWLEDGEMENTS

First and foremost I would like to thank the Almighty God, for giving me the courage to begin and complete this PhD study

Special thanks go to my supervisor Dr Asheena Singh-Pillay who truly welcomed me to this journey, groomed me and moulded my view of research at this level. Her research skills hugely influenced my pursuit of this study. Your timeous and meticulous attending to my chapters gave me inspiration and courage to travel the journey. You transformed me profoundly, you are my model, my mentor a true erudite academician, researcher and supervisor. I also express appreciation to Dr Ronicka Mudaly, my co-supervisor for truly engaging in the co-construction of knowledge during this journey, her constructive critique and comments during the period of the journey gave me inspiration and courage.

I would not leave out Academic Leader of Research and Higher Degrees, School of Education Professor Morojelo who visited my work place and gave a series of lectures and kick-started the journey through his encouragements and warm presentations.

I appreciate my wife, Agnes, my children, Farai, Vimbai, Kudzaishe, Melitha and Norman, for their enduring patience, backing, motivation and praise, I love you all dearly. Many thanks go to relatives and friends who appreciated what I was doing throughout the journey. Without your encouragement and patience this work would not have proceeded. Great appreciation goes to Thomas Firomumwe, my beloved former student in my department, for his computer skills that made some of my tasks attainable. Your contribution to this thesis was wonderful and full of adventure. May Almighty continue to give you wisdom. Many thanks to colleagues from teacher development and curriculum studies who continued to give me words of encouragement that inspired me to endure this journey.

Finally, I sincerely thank my participants for making the time to be part of my study. I am eternally grateful for all your contributions to the research.

ABSTRACT

Official Zimbabwean policy emphasises the need for communities to address environmental issues and develop values, skills and behaviour consistent with natural resource management for sustainable development. However, people of all ages engage in activities that degrade the biophysical environment. Thus, there is a need to transform the way the Zimbabwean population thinks and acts towards the environment. I argue, first, that teachers are key role players in the implementation of environmental education (EE) as well as raising awareness of environmental issues among learners and the communities in which they live and, second, that what teachers think, believe and know about EE affects and facilitates their teaching. Thus teachers need to be equipped with knowledge of environmental processes and systems and be committed to spurring learners towards appropriate environmental concern and action.

In order to explore how pre-service geography teachers (PSGTs) can best understand and learn EE, this qualitative case study is located within the interpretative paradigm. Experiential learning theory (ELT) and participatory action research (PAR) underpin the study. The study site was a university in Zimbabwe. The study sought to ascertain pre-service geography teachers' understanding of EE, their attitude towards teaching of EE and how they learn EE. Twenty pre-service geography teachers in their second year of study at the university were purposively selected to participate in this study. Data were generated through questionnaires, focus group interviews, photo-narratives and reflective diaries. Content analysis was used to analyse the data. The findings indicated that PSGTs understand that EE teaches people to conserve natural resources, develops their understanding of human-environment interactions and of the Earth's processes, develops their skills in science and geography and promotes safe sustainable interactions. Pre-service geography teachers also believe that it is important to teach EE and that having sufficient pedagogical content knowledge (PCK) and a positive attitude would enable them to teach EE. Insufficient PCK and lack of resources are factors that would constrain the teaching of EE. The findings of this study highlight that teachers are more than mere subject matter specialists who are *au fait* with content knowledge and pedagogical knowledge, they also carry with them into the classroom their disposition. Their disposition is an innate part of who they are, influences their intuitions, their ability to make judgements, how they develop content, interpret curriculum, improvise, respond to situations as they occur whilst teaching and reflect on their teaching. Hence, the study makes a recommendation for the inclusion of an affective component in the current model of PCK, which has until now fore grounded only cognitive components

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LIST OF ACRONYMS AND ABBREVIATIONS

CK	Content knowledge
EE	Environmental education
EFS	Education for sustainability
ELT	Experiential learning theory
EMA	Environmental Management Agency
ESD	Education for sustainable development
GIS	Geographic Information System
KoC	Knowledge of Context
NAAEE	North American Association for Environmental Education
OECD	Organisation for Economic Co-operation and Development
PAR	Participatory action research
PCK	Pedagogical content knowledge
PK	Pedagogical knowledge
RD	Reflective diary
SADC	Southern African Development Community
SD	Sustainable development
SK	Subject knowledge
SMK	Subject matter knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization
ZNEEPS	Zimbabwe National Environmental Education Policy and Strategies

CHAPTER 1: INTRODUCTION

In Zimbabwe, despite the well-formulated policies that exist on environmental education (EE), people continue to engage in activities that degrade the biophysical environment (Shava, 2003, Sango and Nhamo, 2013, Ndhlovu and Mpofu, 2016). These activities result in pollution, soil erosion, overfishing, deforestation, illegal panning, land degradation, veld fires, and siltation of a variety of water bodies. The continuance of such environmentally degrading activities may be attributed to causes such as a high rate of poverty, unemployment, an anthropocentric view of the biophysical environment or the lack of educational materials tailored to meet the needs of different sections of the community (Zimbabwe National Environmental Education Policy and Strategies, ZNEEPS 2009). To overcome these environmental challenges and to develop more environmentally conscious communities there is a need to transform the way the Zimbabwean population thinks and acts towards the environment. In other words, as stated by the the United Nations Educational, Scientific and Cultural Organization there needs to be capacity building of skills, values and attitudes that lead to more environmentally conscious communities United Nations Educational Scientific Organisation (UNESCO, 2016). This requires pro-environmental behaviour and actions among the Zimbabwean community. Teachers are seen as key role players or agents in implementing EE, through the science and geography curricula, as well as raising awareness of environmental issues among learners and the communities in which they live (UNESCO, 2016). For teachers to be drivers of environmental literacy they need to be equipped with knowledge of environmental processes and systems. They should be committed to encouraging learners in appropriate environmental concern and action (Perrotta, Moseley and Cantu, 2008). Studies by Ismail (2017) Symons (2008), Ernst (2009) Robottom and Graber (2000) have found that teachers' poor knowledge of environmental issues arising from a lack of appropriate training in their teacher education programme constrained the implementation of education for sustainability (EFS) and the development of pro-environmental behaviour and actions among learners. Hence, many practicing teachers are unable to drive the expected community changes in addressing environmental challenges or in developing pro-environmental behaviour and actions among communities (Bronfman, Cisternas, López-Vázquez, Maza, and Oyanedel, 2015). Thus, in order to understand geography teachers' capacity for environmental education, it is crucial to pay attention to the training of pre-service geography teachers in terms of what they think, believe and know about EE, because it affects how they will facilitate their teaching of EE when they enter the profession as qualified teachers.

This study explores pre-service geography teachers' (PSGTs) understanding and learning of environmental education (EE) at the Lowveld University in an attempt to address the human impact on the environments. Pre-service geography teachers (PSGTs) are considered to be ideally positioned to serve as agents of social change who can drive an EE agenda, at both school and community levels, when they qualify as teachers. In other words, PSGTs are looked upon as individuals who can help to bring about positive changes in the lives of people with regard to environmental issues.

This chapter begins with the background of the study. It goes on to detail the purpose of the research, the associated objectives and the research questions of the study, the rationale for the study as well as the significance of the research. The chapter concludes with a brief review of the approach adopted for the research and then outlines the contents of the thesis chapters that will follow.

1.1 Background of the study

Since the colonial era, Zimbabwe has provided EE in various ways. For example before independence in 1980, it was presented in the form of conservation education in formal, informal and non-formal institutions (Whitlow, 1988). In primary schools, it was taught as Nature Study. After independence, it has been taught as either Environmental Studies or Environmental Science (Shava, 2003). In colleges and universities, it has also been similarly taught as Environmental Science or Environmental Studies or EE. After 23 years of independence, Zimbabwe's National Environmental Education Policy and Strategies (ZNEEPS, 2003) were promulgated after several years of consultation with a wide range of stakeholders. The ZNEEPS seeks to promote environmental awareness with a view to changing people's values, attitudes, and behavior towards their biophysical and cultural environments. Its long term goal is to achieve sustainable development (SD) at local and national levels. Zimbabwe's environmental education policy seeks:

“To make sustainable development a national priority, to take a pro-active role in environmental issues and to respond to environmental challenges facing Zimbabwe at the personal, local, national, regional, and global levels through education and communication processes” (ZNEEPS, 2003, p. 3).

The policy is based on the following objectives (ZNEEPS, 2003):

- (a) To identify and mobilize resources to support self-sustaining EE activities

- (b) To integrate EE in teaching, learning, training and extension programmes in the formal and informal sectors of education
- (c) To raise public awareness of environmental issues and promote holistic management of the environment in all sectors of the community
- (d) To facilitate the development of knowledge, skills, attitudes and values necessary for environmentally sustainable behavior
- (e) To promote SD through the use of all channels of communication
- (f) To encourage sustainable livelihoods within communities usually not reached by formal channels of education and communication
- (g) To protect and promote the use of indigenous knowledge systems
- (h) To support private and public initiatives in EE research
- (i) To ensure monitoring and evaluation of EE programmes and activities in all sectors.

Objectives a, b, c and d are particularly significant in this study, because they are embraced by the aims of the study. The Zimbabwe National Environmental Policy and Strategies thus, underscore the role teachers have to play in the teaching and learning of environmental education and its uptake by its citizens (Raselimo, 2017). Teachers are seen to be ideally positioned to embrace and propagate the ZNEEPS vision among the people of Zimbabwe. Hence, an EE curriculum that is practically oriented and supported by appropriate educational material is a pre-requisite at all levels, be it at formal, non-formal or informal education.

According to the ZNEEPS, formal environmental education is expressed in the primary school curriculum mainly as Environmental Science, with some aspects included in Religious and Moral Education and Social Studies (Nziramasanga, 1999). Furthermore, in the secondary school curriculum, EE is covered in Geography, Natural Sciences and Agriculture (Nziramasanga, 1999). This therefore means EE is available across the formal school curriculum in Zimbabwe.

In many other countries, geography is similarly seen as a vehicle for developing education about sustainable development, environmental concerns and citizenship (Dube, Musara, and Chitamba, 2014; Butt, Hemner, Hernando and Houtsonen, 2006). Geography is meant to give school pupils knowledge of the environment that would influence behavioural, and attitudinal changes by building an environmentally sensitive population, which would then address challenges resulting from human-environment interaction (Summers,

Kruger, Childs and Mant, 2010; Erdoğan, Kostova and Marcinkowski, 2009; Knapp, 2000; UNESCO, 2013, 2016). Therefore, investing in teachers of geography by equipping them with the knowledge and skills required to impart pro-environmental behaviour among learners is also an investment in our learners and their communities as they (learners) will confront environmental challenges throughout adulthood.

It is recognized that the most influential forms of socialization vary over a lifetime. In childhood they are experiences of natural areas, play and family (Chawla & Cushing, 2007). Later on, during adolescence and early adulthood, education and peers are mentioned most often, and among adults it is primarily through pro-environmental organizations that people learn about the environment (Lee, 2009). Therefore, formal education should take advantage of learners' formative years in which to inculcate responsible environmental behaviour. The overall framework of environmental education is the development of students' knowledge, awareness, skills and motivations to protect the environment. That is environmental education endeavours to establish and develop environmentally literate citizenry (United Nations Educational, Scientific and Cultural Organisation, UNESCO, 2005, 2013; North American Association for Environmental Education, NAAEE, 2009a; 2010a). Environmental education aims at empowering learners in social and environmental change; a change which is truly transformative and a change which leads to responsible environmental behaviour (Yavetz, Goldman & Pe'er, 2014).

Although the ZNEEPS was formulated in 2003 (15 years ago) its vision and objectives for EE are not been realised, as is evident in increased rampant environmental degradation (Shoko, 2003; Mapira, 2007; Mapira & Mungwini, 2005; Makwara, 2011; Muchadenyika, 2015). The different forms of environmental degradation plaguing Zimbabwe, such as poor waste management, pollution, global warming and climate change, loss of biodiversity and deforestation are elaborated on next.

Waste management has been cited by Mapira (2011a) as one of the greatest challenges facing local authorities throughout Zimbabwe. A study by Mandevera (2015) found that in spite of the numerous clean-up and anti-litter campaigns, litter has become a common sight along highways and in many urban and peri-urban communities in Zimbabwe. As a city experiences population growth, industrialization and urbanization, the amount of waste per capita to be disposed of also tends to increase; straining existing waste management facilities (Shava, 2003; Mangizvo, 2008; 2010).

There is need to manage waste so that it poses no danger to the ecosystem or human health (Mapira, 2011a). Nevertheless, the country's deteriorating infrastructure has resulted in poor waste management (Chiwandamira, 2000; Makwara, 2011) with consequent outbreaks of diseases such as diarrhoea, dysentery and typhoid (Machivenyika, 2012). In particular, the 2008 cholera outbreak in Zimbabwe was traced back to the collapse of waste management in the country (Muchadenyika, 2012). In this regard, most cities in Zimbabwe face severe sanitation problems and health threats emanating from sewage outflows and burst sewage pipes which resulted in over 3,000 deaths between 2005 and 2009 (Makwara & Magudu, 2013).

Waste management has been a global problem especially in developing countries. The problem has been due to population increases. Zimbabwe has had its share of waste management challenges affecting urban areas more than any other area. These problems range from disease outbreak resulting in loss of lives as outlined above. The overall social impact is loss of lives and production of various proportions.

The accumulation of waste has resulted in many forms of pollution. Air pollution is associated with global warming and climate change, unpredictable wind and rainfall patterns. Sango and Nhamo (2015), Pereir and Limongi (2015), Chagutah (2010), Mujuru, McCrindle, Gurira, Zvinowanda and Marce (2012) have highlighted that an increase in air pollution has led to a global annual temperature rise of 0.8°C since 2018. These changes are caused by emissions of greenhouse gases, which are of largely anthropogenic origin (Intergovernmental Panel on Climate Change, IPCC, 2007, cited in the Zimbabwe Environment Outlook, 2007). According to Sango and Nhamo (2015) and Pereira et al. (2015), carbon dioxide is the primary anthropogenic source of greenhouse gases, and consequent temperature increases have resulted in reduced dam water levels from high evaporation rates, and increased transpiration rates, which adversely affect natural ecosystems.

In Zimbabwe the adverse effects of climate change manifest as heat waves, severe dry spells, cyclones and flooding (Ministry of Environment and Natural Resources Management, 2013; Sango and Nhamo, 2015). Sango and Nhamo (2015) note rainfall patterns as declining by 5%. These changing weather patterns have increased the frequency of droughts. For example droughts were recorded in the years 1967, 1973, 1982/83, 1986/87, 1991/92, 1994/1995 2001/02, 2002/03, 2004/05, and 2006/2007, with the most notable being in 1982, 1992 and 2002 and SDC, cited in the Zimbabwe Environment Outlook, 2007; Ministry of Environment and Natural Resources Management, 2013). The decrease in rainfall in Zimbabwe has resulted in dry rivers, with consequent reduced availability of water for many poor rural communities (Mutekwa, 2016). Communal farmers in such communities seem to struggle to make sense of and adapt to these

catastrophic changes that are linked to climate change. The negative impact of climate change is worsened by Zimbabwe's dependence on agriculture as an economic pillar.

Water pollution affects water quality negatively and interrupts the ecosystem and aquatic life. In Zimbabwe it has given rise to the growth of water hyacinth (Mapira, 2011 a; Gratwicke, Marhall and Nhiwatiwa, 2003). Studies by Chisango, Ncube, Moyo and Gasva (2015) reveal that mines and industrial waste effluent deposited in water bodies becomes a disaster, affecting flora and fauna in Lake Chivero. Globally, the United Nations Development Program estimates that more than 5 million people die each year from diseases related to inadequate waste disposal (Makwara & Magudu, 2013).

Due to climate change there has also been occurrence of floods periodically in Zimbabwe. In Manicaland Province, Cyclone Eline in the year 2006/2007 season damaged 4,866 hectares of timber plantation (Zimbabwe Environment Outlook, 2007, p. 121).

Lack of environmental education and economic instability in Zimbabwe have resulted in high levels of deforestation, as forest land is lost to agriculture and citizens are forced to resort to wood as a source of fuel as well as a source of building material. An example is tobacco farming in Zimbabwe which largely depends on firewood for curing the crop. This has produced a negative impact on the environment as reported in the local media:,

“The majority of smallholder tobacco farmers rely solely on firewood to cure their tobacco. Coal and electricity use are beyond the reach of a large number of smallholder farmers. Research has shown that a smallholder farmer produces up to 1400 kg of tobacco per hectare, needing seven tonnes of firewood to cure the crop. Cumulatively, these tobacco farmers chop about 5,3 million trees each year to support their production – in 2011, an estimated 46 000 hectares of forest had been cleared and about 1,38 million cubic meters of firewood burnt to cure part of a 127 million tobacco output” (The Forestry Commission, 2012 cited in the Business Herald, 11 November 2014).

Detrimental agricultural practices, such as cultivation of marginal areas and stream banks, and felling trees without reforestation, leave the land bare and prone to erosion. It is estimated that about 70 000 hectares of Zimbabwean forests are lost each year to agriculture. For example the vegetation cover in Chivi District

stands at only 30% (Zimbabwe Ministry of Environment and Tourism, 2000). A study by Patterson, Sainy and Russell (2007) showed that commercial forests in Chimanimani, lost about 200 hectares from about 4000 hectares through uncontrolled fires.

Loss of wildlife and biodiversity has become a problem in Zimbabwe as a result of economic problems. Wildlife is at risk: species such as elephants and rhinoceros are at risk of extinction (Zimbabwe Ministry Environment and Tourism, 2000) because the value of elephant ivory and rhinoceros horn makes these animals very vulnerable to poaching. Standley and Emslie (2013) discovered that rhino poaching in 2007 only led to overall decline of white and black rhinoceros in Zimbabwe. Reports by Reuters (2015) and the Telegraph (2015) exposed that 62 elephants had died in Hwange National Park Zimbabwe from illegal cyanide poisoning by poachers targeting their ivory tusks. Studies by Olivia and Porsch (2015) and Standley and Emslie (2013) revealed that between 2006 and 2012, 378 wild animals had been poached in Zimbabwe. From 2006 to 2010 rhino poaching reached 44.5% of the rhino population, whilst the rhino population declined from 1000 in the 1980s to 430 in 1990 (Cumming, 1987; African Rhino Specialist Group, 1992).

Loss of biodiversity and massive loss of vegetation emanate from veld fires, which are often caused by humans. Veld fires lead to both species extinction and species migration as a result of habitat loss and loss of food for grazers and browsers. A study by Nkomo and Sassi (2009) revealed that in 2002 at least 9% of Zimbabwe's total forest area, that is 3500 000 hectares, were lost from veld fires in only one season. As a result of fires, commercial timber plantations declined from 12 million hectares in 1998 to 6.5 million in 2004. The same study revealed that 30 million hectares of savannah grasslands burn annually in Africa.

Agricultural land suffers from erosion as result of poor farming methods and mineral panning, both of which lead to increased sediment deposition in dams and rivers. A study by Van Rooyen, Ramshaw, Moyo, Stirzaker, and Bjornlund (2017) reported soil yield losses of 30 to 50 tons per annum in Zimbabwe. Furthermore, erosion over many years of poor land management has resulted in valuable land becoming unproductive and often abandoned (Tundu, Tumbare & Onema 2018; Morgan, 2009). Many scholars agree that increased environmental problems and water consumption are driven by population growth (Makwara & Gamira, 2012; Vlek & Steg, 2007; Wong, 2007). Soil eroded by water is deposited as sediment, which reduces the design capacity of water reservoirs such as dams, with as much as 1% of the world's reservoir capacity being lost to sedimentation annually (Howard, 2000). Mharapara and Marongwe (2010) report that much of the sediment deposited in dams and rivers results from mineral panning, particularly for gold and diamonds, and argue that 15 500 hectares of land are degraded each year in this way. Other indicators of

land degradation, according to Southern African Development Community (SADC), include loss of vegetation cover, deterioration of rangelands, biodiversity loss, soil erosion and decline of soil fertility, salinization and accumulation of toxic waste (SADC, 2008). A study by Chihombori, Nyoni and Gamira (2013) revealed that dams in Masvingo Province had shown an increased rate and intensity of siltation due to mismanagement of the catchment areas. The study recorded a rate of 8.3% sediment deposition each year in Marah Dam. Studies by Chitata, Mugabe and Kashaigili (2014) revealed that Mutangi Dam in the Southern part of Zimbabwe has lost 37% of its water in 12 years from siltation (2000 – 2012). This shows mismanagement of catchment areas that allows poor agriculture practices and mineral panning, which results in accumulation of sediment in dams and rivers, consequently affecting the aquatic ecosystem. The influence of human impact on the environment, with its many environmental consequences, means that teacher education in EE becomes crucial. As noted earlier, UNESCO (2016) and ZNEEPS (2003) indicate that teachers should be drivers of EE in the school system. This study, therefore paid attention to pre-service geography teachers learning and understanding of EE.

1.2 Purpose and focus of this study

The purpose of this study was to explore pre-service geography teachers' understanding and learning of environmental education at the Lowveld University in Zimbabwe.

1.3. Research objectives

The study is underpinned by the following three objectives:

1.3.1 To determine pre-service geography teachers' understanding of environmental education.

1.3.2. To establish pre-service geography teachers' attitudes towards teaching of environmental education.

This objective has two sub-objectives:

1.3.2.1. To identify factors which enable their learning and teaching of EE.

1.3.2.2. To identify factors which constrain their learning and teaching of EE.

1.3.3. To explore how pre-service geography teachers learn environmental education.

1.4 Research Questions

The study is underpinned by the following three research questions, as follows:

1. What is pre-service geography teachers' understanding of environmental education?
2. What are pre-service geography teachers' attitudes towards the teaching of environmental education? This question entails two research sub-questions.
 - 2.1 What factors enable the teaching of EE?
 - 2.2 What factors constrain the teaching of EE?
3. How do pre-service geography teachers learn EE?

1.5 Rationale for the Study

I am a practicing Geography and Environmental Science teacher educator at a Zimbabwean university, as well as being an avid environmental activist. There are three main reasons that have motivated me to carry out this study, as follows.

Firstly, a study by the European Commission (2013) found environmental degradation was a major problem in Zimbabwe, which is impacting negatively the quality of life in the country. This resonates well with observations by Mathe and Phiri (2016) that the most common diseases of our civilization are directly linked to poor quality of life and environmental pollution. To overcome these environmental challenges people need to have the knowledge, skills, attitudes, motivation and commitment to work individually and collectively to find and institute solutions to the current problems, whilst simultaneously working to prevent new ones (Dube, 2015; Shava, 2003; Makwara & Magudu, 2013).

Secondly, the Zimbabwean National Environmental Education Policy and Strategies (ZNEEPS) (2003) stipulate that EE is a national priority and that citizens should take a proactive role in environmental issues and respond to environmental challenges facing Zimbabwe. The goal of the ZNEEPS is to promote public awareness of and engagement in environmental education (EE) so as to address the environmental challenges facing Zimbabwe. To espouse the goals of the ZNEEPS, the Zimbabwean Ministry of Primary and Secondary Education in consultation with the Curriculum Development Unit developed a school policy

that advocates teaching of EE. For example, the Geography (2015-2022 and 2016-2022) curriculum requires teachers to teach learners about the environment, the impact of humans on the environment, conservation and the environment as a resource. For teachers to be able to embed and embrace EE in their practice, they need to be trained to teach EE. If teachers are not properly trained to teach EE it will impact the learning of EE by learners at schools. As a teacher educator, I am therefore motivated to conduct research in this aspect of teacher education.

The third reason that motivated me to undertake this study were the knowledge gaps regarding EE that I have observed amongst pre-service geography teachers when they enter university, despite the curriculum policy for Geography stipulating that EE be taught in schools. These pre-service teachers have low environmental consciousness and attitudes towards the environment. My view is that pre-service geography teachers are part of the population with the intellectual capability to assimilate the many dimensions associated with the concept of EE and sustainability. They are at the formative stage of early adulthood in which they can be encouraged to experiment with ideas to find creative solutions to problems in their chosen field of work (Raselimo, 2017). It is in this regard that I saw pre-service geography teachers as an invaluable potential human capital resource in the EE sector. Therefore, there is a need to equip these teachers with pedagogical content knowledge (PCK) and practical skills on EE, in order to promote the values and principles espoused in the ZNEEPS. Once equipped with such knowledge both teachers and pupils should then have the ability to address environmental challenges facing all sectors in Zimbabwe, that would invariably affect the quality of life now and in the future. As a teacher educator I am well positioned to undertake an exploration of pre-service geography teachers' understanding and learning of environmental education.

Fourthly, the rationale is also based on previous studies which focus on EE in teacher education (Sponarski, Vaske, Bath, A. & Loeffler, 2016; Summers, & Childs, 2007).

1.6 Significance of the study

The findings from this exploration of pre-service geography teachers' understanding and learning of EE could inform policies at various levels and across different sectors. In education the finding will be relevant for higher education institutions such as the Lowveld University, especially for the departments charged with pre-service geography teacher preparation, for the Curriculum Development Unit in charge of the Geography school curriculum for national examinations at Zimbabwe Junior Certificate level, O level and

A level, and for principals of high schools who manage education. Local municipalities may also use the report to involve their residents in an effort to create a clean environment in all areas under their jurisdiction.

1.7 Research Design

This qualitative case study, which explores pre-service geography teachers' understanding and learning of EE at the Lowveld University, embraces the interpretive paradigm. A key characteristic of the interpretive paradigm is to understand the phenomenon being explored (in this case pre-service geography teachers' understanding and learning of environmental education) from the perspective and lived realities of the participants (the pre-service geography teachers). Exploring pre-service geography teachers' understanding and learning would form a basis for empowering them to become champions of environmental education in the schools, local community and Zimbabwe as a whole. Data were generated in three phases: through open-ended questionnaires (phase 1), focus group interviews (phase 2), photo narratives and reflective diaries (phase 3). Given the relevance of geography and environmental education in human-environment interaction, in phase 3 of data generation, pre-service geography teachers engaged in experiential learning and participatory action research to identify and address common environmental challenges in their local communities. The generation of data by multiple instruments allowed for triangulation when answering the research questions and it also contributed to the trustworthiness of the data.

1.8 Research findings

Multiple methods were used to generate data that informed the findings of this study. The findings for Research Question 1 revealed that pre-service geography teachers' understanding of EE can be summarised as follows.

- EE teaches people to conserve natural resources and use them in a sustainable way (intergenerational equity). Resources are supposed to benefit present and future generations and for that to happen pro-environmental behaviour should be inculcated in all age groups.
- EE develops understanding of human interactions with the environment, and human impact on the environment. The environment is a source of human livelihood, such as mining, agriculture, fishing, or tourism, that contribute significantly to gross domestic products (GDP) of most countries.
- EE develops understanding of the Earth's processes. Understanding these is the first step to the conservation and preservation of natural resources. Knowledge of these processes should be used to discourage humans from wantonly damaging the environment. How Earth processes come about

reminds human beings of how long it would take for a damaged environment to recover from such damage.

- EE develops scientific skills in science and geography, such as observing, collecting, experimenting, comparing, predicting and investigating. These would in turn enable the study of human-environmental interaction fully and possibly allow for preservation techniques for the good of both the environment and humankind.
- EE promotes safe sustainable interactions. In a quest to meet developmental needs humans are over-exploiting natural resources. It is therefore imperative that pro-environmental behaviours are developed that restrain humans from causing pollution of all kinds, climate change, forest fires, deforestation, loss of biodiversity, land degradation and siltation of river bodies.

In terms of Research Question 2, pre-service geography teachers highlighted the importance of teaching EE. They emphasised that their learning of EE had equipped them with content knowledge and pedagogical knowledge needed to teach EE. Further, they reiterated that their teaching of EE would enhance learners' knowledge and skills, enabling them to engage in pro-environmental behaviour.

On factors that enable the teaching of EE, the study established that influencing factors for the pre-service geography teachers were to have sufficient subject content knowledge and pedagogical knowledge as well as positive attitudes. Furthermore, the study revealed constraints such as inadequate teacher training related to pedagogical content in EE (subject content knowledge and pedagogical content knowledge) and lack of resources which could hamper the teaching and learning of EE.

In response to Research Question 3, pre-service geography teachers (PSGTs) engaged in experiential learning and participatory action research (PAR) in identifying and addressing environmental challenges around Masvingo. The findings revealed that groups of PSGTs learnt of the indispensable roles played by influential people, such as church pastors, the Environmental Management Agency (EMA) staff, local council workers and the business world, in dealing with EE challenges. In the process of learning of EE the concept of buy-in from the community is pivotal in changing people's attitudes. Another finding was that providing a large volume of information to people in the informal sectors, such as vegetable vendors or squatters, does not bring about behavioural change. Therefore, an appropriate information package should be tailored to suit this particular sector. The valuable input of stakeholders from the Department of Forestry, EMA and many council departments such as Health and Engineering helped resolve some of the environmental challenges identified.

1.9 Overview of chapters

Chapter 1 has provided the background to the study, its purpose and objectives, the research questions guiding the study, and the rationale and significance of the study. It also provided a brief synopsis of the research design and research findings.

The theoretical framework, consisting of experiential learning theory (ELT) and participatory action research (PAR) were explicated in Chapter 2.

Chapter 3 pays attention to local and international literature concerned with teaching and learning of EE.

The research methodology is discussed in Chapter 4. Attention is paid to the research paradigm, research design, justification for a case study approach, location of the study and sampling. Data generation processes and instruments are described. These are questionnaires, focus group interviews and photo narratives and reflective diaries used to identify the environmental challenges in the local community. This chapter concludes with data analysis strategies that will be used.

In Chapter 5, the study focuses on analysis of emerging themes related to Research Question 1, using data from the questionnaires and focus group interviews. The analysis is guided by the theoretical framework of ELT and PAR.

The emerging themes related to Research Question 2 are presented in Chapter 6.

Chapter 7 presents the themes related to Research Question 3. Data from the photo narratives and reflective diaries are used to answer the question.

The thesis ends with Chapter 8, which provides a summary of findings from the study and highlights recommendations emanating from the findings.

1.10 Summary of Chapter 1

In this chapter I introduced the study, which explored pre-service geography teachers' understanding and learning of environmental education at the Lowveld University in Zimbabwe. The chapter provided the background to the study, the rationale behind it, the purpose, objectives and research questions guiding the study and the significance of the study. Further, a brief synopsis of the research design, research findings

and an overview of subsequent chapters were provided. The next chapter will look at the theoretical framework, namely experiential learning theory and participatory action research.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

This chapter presents the following parts of the theoretical framework:

- Possible theories that could influence the study
- Experiential Learning Theory (ELT)
- Participatory Action Research
- Links between ELT and PAR
- More significant attention is paid to how understanding is developed through following neurological pathways.

2.2 Possible theories

Transformation in learning and progressing towards pro-environmental behaviour is linked to several ideas. This study makes a brief reference to the contributions from four theories listed below and which are then discussed.

- Holistic education,
- Noel Nodding's ethics of care,
- Transformational learning theory, and
- Significant life experiences (Palmer, 2002),

According to proponents of holistic education the world is a seamless, dynamic, interconnected whole, of which human beings are a part. Holism accepts that humans are multidimensional beings with physical, mental, emotional and spiritual aspects. Similarly, environmental education should educate the whole person in order to bring learners to be balanced and connected, and have inclusive relationships with the world. EE should educate the head, the heart, and the hands (Nazir, 2016). Scholars such as Miller (2007) and Nazir (2016) are of the view that holistic education should bring students to an awareness of nature's wholeness and their place in it; something that can be regarded as deep ecology aimed at influencing behavioural change.

Noel Nodding's ethics of care posits that EE is care-based education, which is fundamentally relational, which should emphasise themes of attachment (deep ecology), interdependence and which should allow

individuals to be connected to the environment (Nazir, 2016). Incorporating these ethics of care into EE is encouraged by so as to provide learners with an opportunity to see and learn to love the Earth as a broadened sense of the self (Fein (2003). Martin (2005) in Nazir (2016) sees the application of care to EE as having the potential to develop a personal and emotional relationship between students and places, entities and non-human individuals, which are essentially different but intrinsically valuable.

Transformational learning theory advocates such as Mezirow (2000) and O’Sullivan (2003) believe that education is about more than simply transmitting facts and skills. They contend that true learning should bring about deep changes that move people into new and positive ways of behaving towards the environment. “Transformative learning should involve a deep, structural shift in the basic premises of thought, feelings and actions” (O’Sullivan, 2003, p.327). This transformation should result in a shift of consciousness that dramatically and irreversibly alters our way of being in the world. Likewise, EE should involve our understanding of ourselves, our self-locations; our relationship with humans and with the natural world. Palmer (2002) identified life experiences that led to a practical concern for the environment, which could lead to actions such as practical conservation (tree planting, wildlife, gardening, recycling activities), membership of organizations actively involved in environmental matters, enjoying outdoor activities (bird watching, hiking), making a conscious and regular effort to buy “environmentally friendly household goods and to operate a green lifestyle.”

Arising, from these theories, a common underlying idea is that EE, which is aimed at consciousness raising, requires a shift from the way educators view people, reality and education. Although presenting useful ideas, the preceding theories focus neither on understanding, as implied in the title of the study, nor on constructs that are required to develop understanding, such as identification, implementation, evaluation and reflection. Therefore, they are judged to be unsuitable frameworks for this study.

2.3 Experiential Learning Theory (ELT)

Experiential learning theory (ELT) appears to offer a valid and plausible framework to learning geography in higher education. Some of the theory’s appeal is that it provides a rationale for a variety of learning methods that have recently received much attention in higher education and environmental education. These learning methods include independent learning, learning by doing, work-based learning and problem-

based learning (Buckingham-Hatfield, 2015). The experiential learning theory maybe applied widely in learning geography where a range of learning experiences are designed to make students aware. Students may also become reflective learners and identifying their own learning styles. The theory may also be applied to assist staff in becoming reflective teachers through identification, evaluation and reflection (Burkill, Corey & Jenkins, 2000) In the context of this study, the above advantages made this theory suitable.

Guided by experiential learning theory, where, learning is change, change comes from an understanding, which influences behavioural change, this study developed three research questions namely:

- 1 What are pre-service geography teachers' understandings of environmental education?
- 2 What are pre-service geography teachers' attitudes towards teaching of environmental education in schools?
 - 2.1 What factors enable their teaching and learning of EE
 - 2.2 What factors constrain their teaching and learning of EE?
- 3 How do pre-service geography teachers learn environmental education?

The ELT theory is built on six tenets, as follows.

1. Learning is best conceived as a process that first involves concrete experience (CE), followed by reflective observation (RO), third comes abstract hypothesis and finally, active testing. This means that learning is not perceived in terms of outcomes, rather it is a process that involves all four of these stages. In the context of EE, the learning process through the school and university system is that individuals gain awareness of their environment and acquire knowledge, skills, values and experiences and also the quality of determination, which will enable them to solve present and future environmental problems. As Dewey noted many years ago, "Education must be conceived as a continuing reconstruction of experience: The process and goal of education are one and the same" (Dewey, 1897, p.79).
2. All learning is relearning. A process best facilitates learning if it draws out the students' existing beliefs and ideas about a topic so that these can be examined, tested and integrated with new, more refined ideas. This is shown by the ELT cycle which proposes that learning originates from concrete experience through to reflective observation, followed by abstract hypothesis and active testing; hence the term experiential learning (Zull, 2002). This means that new knowledge is interrogated through reflective observation, active hypothesis and active testing. Dewey's experiential education

framework engages students in a challenging situation or learning experience that is created by an educator, but experienced by the participant (Roberts, 2012; Warren & Loeffler, 2006).

3. Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world (Holdsworth & Thomas, 2016). Conflict, differences and disagreement are what drive the learning process. In the process of learning one is called upon to move back and forth between opposing modes of reflection and action and feeling and thinking. Hence, Holdsworth and Thomas (2016) suggest that any educational change programme should have four elements; namely, confrontation, self-awareness, availability of alternatives and building commitment to a new conception. These approaches merge direct experience, which is meaningful to the learner, with guided reflection and analysis of the experience (National Research Council, 2000). Reflection and internal analysis facilitate the learning experience and make it meaningful to the student (Sponarski, Vaske, Bath & Loeffler, 2016). Experiential learning is participant focused, but framed and chaperoned by the teacher (Joplin, 2008). Applied in this study pre-service geography teachers will identify environmental challenges and, through identification, evaluation and reflection, develop interventions to solve them while at the same time furthering their understanding and experiencing transformation of their attitudes to EE.
4. Learning is a holistic process of adaptation to the world. As outlined earlier, holistic education accepts that humans are multidimensional beings with physical, mental, emotional and spiritual needs. Accordingly, EE should educate the head, heart and the hands, which is referred to as knowledge acquisition, skills acquisition, values acquisition and the development of competencies needed to solve present and future environmental problems. Learning involves the integrated functioning of the total person (thinking, feeling, perceiving and behaving) not only cognition. In support, Higgins and Nicol (2011) add that experience must involve the multidimensional engagement of the mind, emotions and senses. The research question, *What are pre-service geography teachers' attitudes towards teaching of EE?* borrows from ELT in that knowledge influences attitudes and attitudes in turn influence behaviour, which is the ultimate goal of environmental education.
5. Learning results from synergetic transactions between the person and the environment. Outdoor education has always been part of the school curriculum, in order to increase students' connection to nature and to influence their learning positively through discovery, observation and interpretation of the natural setting (Dieser & Bogner, 2016). Such experiences can come in the form of field trips to museums, zoos or national parks. Group projects that are experiential, such as identifying

environmental challenges in the communities and making efforts to solve them through reflective approaches, were employed in this study. In Piaget's terms, the learning occurs through equilibration of the dialectic process of assimilating new experiences into existing concepts and accommodating existing concepts to new experiences.

6. Learning is the process of creating knowledge. ELT proposes a constructivist theory of learning, whereby social knowledge is created and recreated in the personal knowledge of the learner. By studying geography across various levels, the subject is contributing towards creation of environmental knowledge which this study is investigating. This is a continuous process from Junior Certificate, through O and A levels, to university. In my study pre-service geography teachers would be engaged in identifying an environmental challenge, studying it through photo-narratives and reflective diaries and making a report.

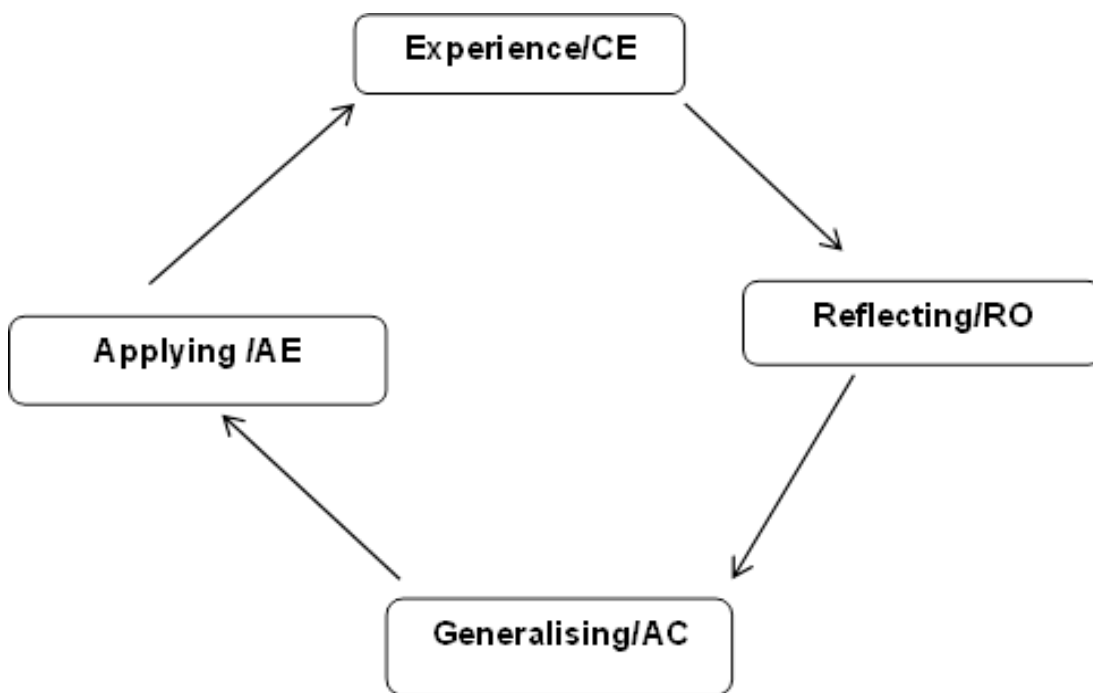


Figure 1 Experiential Learning Theory (Kolb, 1984)

ELT is a process, in that learning is cyclic in the sense that one intervention leads into another. This is shown in Figure 1 above.

The ELT model portrays two dialectically related modes of grasping experience, that is, concrete experience (CE) and abstract conceptualization (AC). The learner *learns* in the first two stages and in the next two modes of transforming experience, that is Reflective Observation (RO) and Active Experimentation (AE) or testing, the learner *reflects* on acquired knowledge and tries out newly created knowledge to solve problems in new experiences. ELT shares common characteristics with fieldwork, which is the hallmark of good geography education. Geography should be taught mainly through fieldwork that is largely experiential. Experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that are responsive to contextual demands. This process is portrayed as an idealized learning cycle or spiral wherein the learner “touches all the constructs”; thus experiencing, reflecting, thinking and acting in a recursive process that is responsive to the learning situation and what is being learned. Immediate or concrete experiences are the bases for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn.

Zull (2002), a biologist and founding director of Case Western Reserve University, the University Centre for Innovation in Teaching and Education (UCITE), saw a link between ELT and neuroscience research. He suggests that this process of experiential learning is related to the process of brain functioning, which is illustrated by Figure 2 below. Zull suggests that learning starts as concrete experience, information is processed through the sensory and post sensory cortex and moves to reflective observation which involves the temporal integrative, creating new abstract conceptions in the frontal integrative cortex, then active testing involves the pre-motor and motor brain, leading to action. In other words, the learning cycle arises from the structure of the brain. This means that ELT is a holistic integrative perspective on learning that combines experience, perception, cognition and behaviour (Kolb, 1984). The theory was therefore judged as appropriate to underpin this exploration of pre-service geography teachers’ understanding and learning of environmental education.

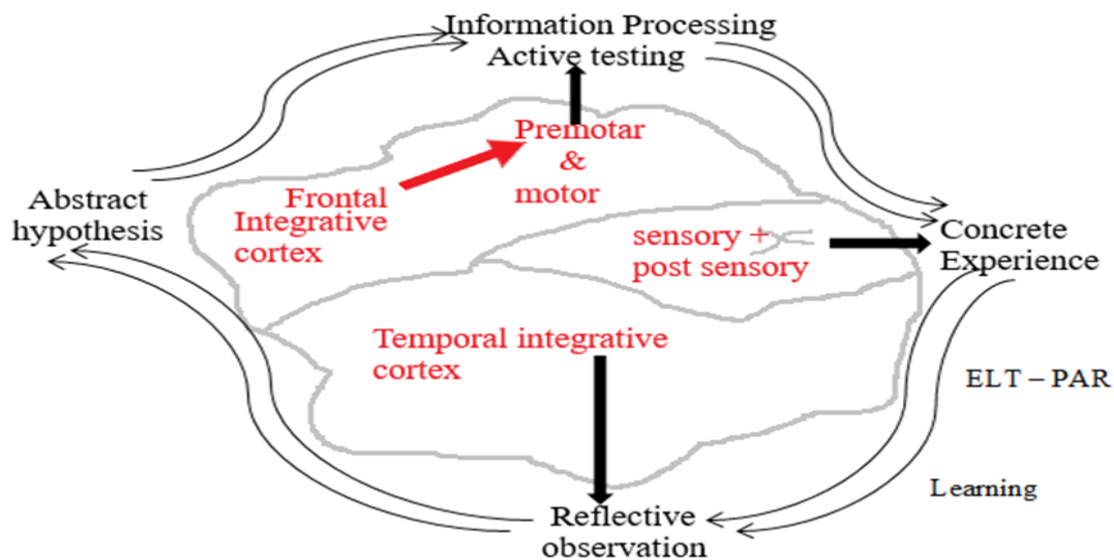


Figure 2. The Cycle of ELT (Source: Passarelli & Kolb, 2011)

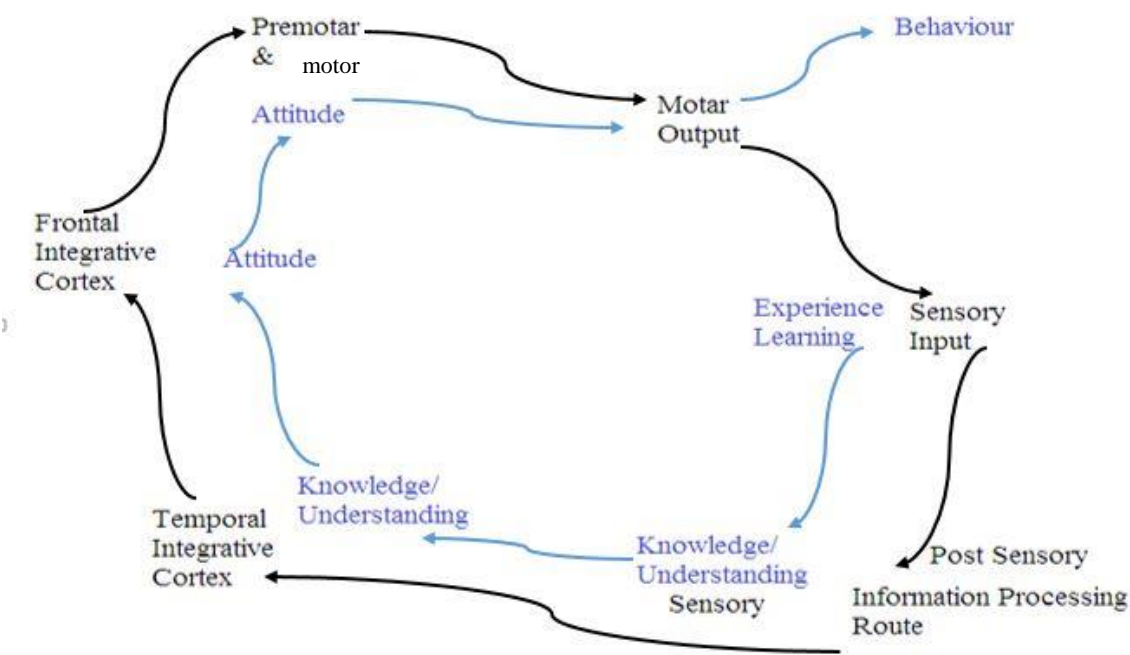


Figure 3. A simplified ELT and how understanding influences attitude and ultimately behaviour (Source: Passarelli & Kolb, 2011)

ELT best guides this study because it shows how understanding is arrived at based on neurological pathways, as shown in Figure 2 and 3

The data collection methods and instruments used, namely questionnaires, focus group interviews, photo narratives and reflective diaries, are largely influenced by ELT as applied to understanding of environmental issues. Understanding is the basis of desirable attitudes that may ultimately influence pro-environmental behaviour. Several studies on the sources and roles of environmental attitudes have revealed that people with highly positive environmental attitudes tend to act more pro-environmentally (Bronfman, Cisternas, Lopez-Vazquez, Maza & Oyanedel, 2015; Kollmus & Agyeman, 2002; Chen, Peterson, Hull, Lu, Lee, Hong & Liu, 2011; Fielding & Head, 2011). A study by Georgopoulos, Birbili and Dimitiou (2011) on exploring early childhood teachers' perceptions on the relationship between experiential education and EE found that in EE everything is experiential; this means that, in order to have personal meaning, every learning activity should connect to peoples' lives or context. Real life experiences are important because they enhance "sensory exploration and awareness" (Georgopoulos et al., 2011). The sensory approach forms the basis of experiential ways of knowing things by creating knowledge through transformation of experience (Kolb, 1984, p.38). EE should be an experience designed to create a concern and appreciation of whatever exists around the person so as to be willing to protect it.

A related study by Sponarski, Vaske, Bath, and Loeffler (2016) used experiential education for visitors' to a Canadian National Park to influence their attitudes and emotions, such as love, towards wild coyotes and other animals, even though coyotes, bears and elk could pose a threat to human safety. The education was designed experientially with such success that it transformed people' attitudes towards animals. Implications for the study are that educational programmes designed to influence attitudes and love for nature have to be experimentally formulated in order to transform people. People have to experience all constructs of ELT to realise change and change signals the occurrence of learning.

A further study by Nazi and Pedretti (2015) focused on the application of experiential learning and its impact of managing an outdoor learning centre. The study found that experientially designed education directed at environmental consciousness requires that people be provided with deep engaging experiences that afford authenticity, multidimensionality and serendipity. It means that EE should provide people with educational experiences that truly engage all the senses, the mind and emotions, therefore learning is a sensory experience (Zull, 2002). In order to create new insights for people, education should involve multidimensional engagement of all three: the senses, mind and emotions. This results in consciousness raising and moving individuals from lower to newer and higher levels of insights.

A criticism of ELT could be that it assumes that new knowledge automatically translates into attitudinal and behavioural change. However, how this knowledge is acquired could be significant; knowledge construction through experiences that prioritise engagement, where one is fully immersed in the EE activity, could be the most effective in developing pro-environmental attitudes and behaviour.

Therefore, when EE and experiential learning are blended they can generate active and truly transformed citizens of the present and future who care about the environment. The application and influence of ELT can be summarised as in Figure 4 below.

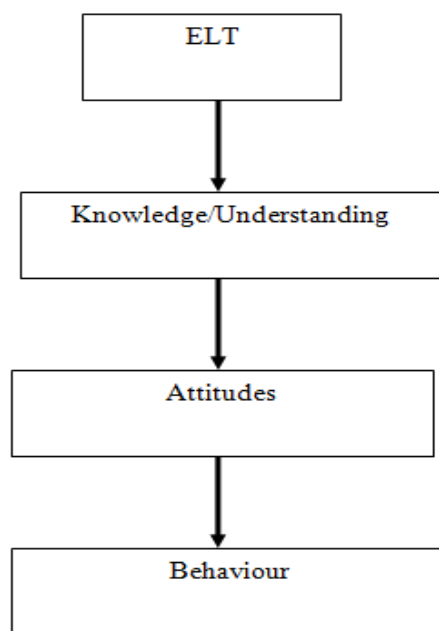


Figure 4. The summary of application and influences of ELT (Source: Kolb, 1984)

The above figure explains the influence of ELT on behaviour change via attitude. Continuous exposure to EE knowledge may ultimately influence behaviour

2.4 Participatory Action Research (PAR)

The goals, principles and guidelines of EE (UNESCO, 2016) suggest a particular orientation of curriculum and pedagogical practices, in which learners engage individually or as a group in problem solving through action based activities (Shah & Jehangir, 2006). The application of participatory action research (PAR) was influenced by the view that the environment is a community project in which everyone should be involved. Learning was influenced by ELT as fieldwork in identification of the problem, that is providing a concrete experience, formulation of an initial hypothesis, which is abstract conceptualisation, then data collection and analysis or reflective observation, followed by drawing conclusions or the reformulation of the hypothesis, that is active experimentation. Pre-service Geography teachers identified deforestation, land

pollution, water pollution and burst sewerage pipes as some of the common challenges their community was facing. Therefore, in this study, ELT is complemented by participatory action research.

Participatory action research (PAR) is an approach to research that emphasises participation and action. It seeks to understand the world by trying to change it, collaboratively, following reflection. PAR emphasises collective inquiry and experimentation grounded in experience and social history. PAR represents a broad tradition of collective self-experimentation backed up by evidential reasoning, fact-finding and learning. All formulations of PAR have the common idea that research and action must be done ‘with’ people and not ‘on’ or ‘for’ people (Brock & Pettit, 2007; Chevalier & Buckles, 2008, 2013; Kindon, Pain & Kesby, 2007; Bradbury, 2008; Swantz, 2008; Creswell, 2012). Inquiry based on PAR principles seeks to make sense of the world through collective efforts to transform it, as opposed to simply observing and studying human behaviour and people’s views about reality in the hope that meaningful change will eventually emerge. Therefore, participatory action research draws from Lewin’s work on organizational development and Dewey’s (1897) emphasis on learning from experience. Their contributions involve PAR as a flexible, scientific approach to planned change that proceeds through a spiral of steps, each of which is composed of ‘a circle of planning, action and fact-finding about the result of action’. Participatory action research takes spiral steps that are similar to experiential learning theory as shown below in Figure5.

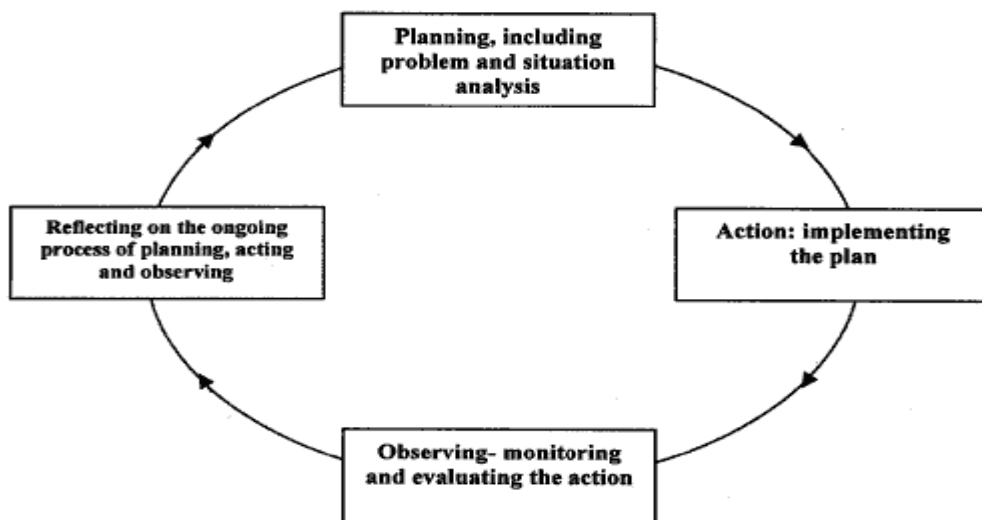


Figure 5. Action Research (Source: Hollingsworth, 2001)

PAR will be used to guide this study’s research question on how pre-service geography teachers can learn EE so as to influence positive attitudes towards EE. In using PAR to identify challenges, PSGTs will study

and provide possible solutions to problems in a participatory way. Sustainable human co-existence with ecosystems requires all communities to manage the environment. It is believed that through the application of ELT in knowledge generation PSGTs are long term beneficiaries of a sustainable environment. Local institutions are heavily indebted to ELT and PAR through the use of field educational tours and field trips through which students ultimately benefit immensely in terms of environmental education.

2.5 Links between EE and ELT and PAR

The theoretical frameworks ELT and PAR are considered here against a backdrop of global goals of environmental education as developed by the Belgrade Charter of (UNESCO, 1975) and Tbilisi Declaration of 1978 as reaffirmed by UNESCO in 2005. The Belgrade Charter and Tbilisi Declaration enumerated the goals and overall framework of environmental education as being awareness, knowledge, skills, attitudes and motivations (Danis, 2014). These are fundamental characteristics of any environmental education programme that any institution could develop, including that for pre-service geography education at the Lowveld University. A focus area of this study was pre-service geography teachers' understanding of EE. Pre-service geography teachers, who are entering university, are a product of the high school curriculum. Accordingly, when they enrol at university planning to major in geography, these pre-service teachers should have been already exposed to EE and should be environmentally literate. It could be expected that an environmentally literate person is someone who, individually, and together with others, makes informed and knowledgeable decisions concerning the environment; is willing to act on those decisions to improve the well-being of others, societies and the global environment; participates in civic life (Organisation for Economic Co-operation and Development, OECD, 2005, 2009, 2013a, 2013b; NAAEE, 2000, 2004, 2009, 2010a, 2010b, 2010c). In summary, the attributes that an environmentally literate person should have include:

- Knowledge and understanding on a wide range of environmental concepts, problems and issues. These are expected to have been developed through geography at various levels of secondary geography education through into university. A focus area of this study is PSGTs understanding of EE.
- A set of well-developed cognitive and affective (attitudes and values) dispositions, acquired and developed over time. Understanding results in knowledge acquisition which influences attitudes and attitudes in turn influences behavior (action).

- A set of competences (cognitive skills and abilities).
- Appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts
(OECD, 2005, 2009, 2013a, 2013b; NAAEE, 2000, 2004, 2009, 2010a, 2010b, 2010c).

The above components (cognitive knowledge, skills and abilities; affective disposition and behavioural strategies) are related and progressively developed over the course of an individual's life. This means that a person evolves progressively through the environmental literacy continuum. The geography curriculum develops these skills and values mainly through fieldwork from lower, middle and upper secondary school into university; hence the significance and relevance of this study, which is appropriately underpinned by the experiential learning theory and participatory action research. According to Danis (2014) and Hollweg, Taylor, Bybee, Marcinkowski, McBeth and Zoido (2011), a person who has imbibed environmental knowledge over a sufficient duration has better environmental knowledge which influences attitudes and behaviour for the preservation of the environment.

2.6 Summary of Chapter 2

The chapter looked at background to the global EE initiatives as they originate from the Belgrade Charter and Tbilisi Declaration. The theoretical framework, consisting founded on experiential learning theory and participatory action research was outlined, and the influence of the theories on the study was explored. The research questions are heavily influenced by ELT. It is clear from this chapter that human behaviour towards the environment is a function of knowledge. Besides its influence, local educational institutions in Zimbabwe use the theoretical frameworks in the updated curriculum, which has a strong thrust towards experiential ways of knowing.

CHAPTER 3: REVIEW OF RELATED LITERATURE

3.1 Introduction

The literature review explores local and international literature related to the major aim of this study, which is an exploration of pre-service geography teachers' understanding and learning of EE at the Lowveld University. This chapter begins with definitions of key terms that underpin this study. It continues with globalization and EE. Next I discuss universities and education for sustainable development (ESD), the interdisciplinary nature of geography, Zimbabwe's approach to teaching EE, the philosophical basis of EE, environmental literacy and concern for the environment. Finally, I focus on the nexus of teacher education and EE. I explore teachers' attitudes towards EE, teacher training in Zimbabwe, teachers' understanding of EE teacher education linked to cognitive and affective domains, and knowledge of context, teaching and learning of EE and the application of ELT and PAR.

Exploration of pre-service geography teachers' understanding and learning should be seen against global changes (climate change, heat waves and forest fires, hurricanes, typhoons and cyclones, floods and landslides) and local concerns (pollution, mineral panning, soil erosion, siltation of water bodies, deforestation and wildlife loss). These challenges lead to growing environmental degradation, which has necessitated the call for people to transform their attitudes and practices towards the environment. Consequently, education has been recognized as an important tool for conserving the environment, through the cultivation of knowledge, skills, values and positive attitudes towards the environment among people. In a time of environmental degradation and economic globalization, UNESCO (2005b, 2016) states the need for schools to provide a culture of care, connection and a hope for the future. UNESCO (2017) further emphasises that governments of both developed and developing nations are coming to realise that in order for their country to have a sustainable future, the quality of science education that includes EE must be prioritised. The United Nations asserts that education is an indispensable means of "achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and effective public participation in decision making" (University of New England Asia Centre, UNEAC, 2007, p.15). Therefore, pro-environmental education at all levels and in all forms that inculcate pro-environmental values constitutes a vital tool for addressing global problems relevant to environmental education, such as sustainable development, poverty, HIV and AIDS, and environmental degradation.

3.2 Definition of key terms

3.2.1 Environmental Education (EE)

Many scholars define EE as a process through which individuals gain awareness of their environment and acquire knowledge, skills, values, experiences, and determination (Kopnina, 2012; UNESCO, 2005b). The awareness, knowledge, skills, experiences, and determination will enable people to act both individually and collectively to solve present and future environmental problems.

The definition above sums up the main characteristics of environmental education at all levels; that it continues from pre-school through to university and even beyond through informal education as stipulated in ZEEPS (2003, 2009), and that it is a process of developing knowledge in all peoples irrespective of age using various approaches. Knowledge so acquired would over time develop appropriate attitudes and eventually influence pro-environmental action at an individual and collective levels to mitigate environmental problems (Bronfman *et al.*, 2015). This is an inclusive definition that captures all essential elements of an environmental education programme. For this study I have adopted the definition above because EE is *a process that develops knowledge, attitudes and actions in favour of the environment*. The goal of environmental education, according to UNESCO (2005b), is to develop a world population that is aware, and concerned about the environment and its associated problems, and that has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solving current problems and preventing new ones.

Central to EE is the idea that it enhances critical thinking, problem solving and effective decision-making skills; it teaches individuals to weigh up various sides of an argument around environmental issue in order to make informed and responsible decisions. The critical components of EE are awareness and sensitivity to the environment and environmental challenges, knowledge and understanding of the environment and environmental challenges, attitudes of concern for the environment and motivation to improve or maintain environmental quality, skills to identify and help resolve environmental challenges and participation in activities that lead to the resolution of the environmental challenges. The above attributes can be best developed through an action based, practically oriented programme; therefore the application and influence of experiential and participatory ways of developing knowledge, attitudes and skills are significant.

It is with regard to the preceding goals of EE that it is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to solve these problems

and are motivated to work towards their solution (UNESCO, 2005b). The early proponents of EE emphasised that its goal as being a positive change in human relationship with nature (Kopnina, 2012). I therefore, advance the rationale that Zimbabwe's environmental future relies on us as well-educated citizens who are wise stewards and custodians of the very environment that sustains us, our families and communities, and future generations. It is EE that can best help us as individuals to make the complex, conceptual connections between economic prosperity, benefits to society, environmental health and our own well-being. Ultimately, the collective wisdom of our citizens, gained through education, will be the most compelling and most successful strategy for environmental management. The concept of EE is intertwined with the concept of sustainability.

3.2.2 Education for Sustainable Development

The concept of sustainable development (SD), which is linked to EE, emerged from a realisation of the need to “balance economic growth and social progress with environmental concerns” (Banerjee, 2003; Thomas, 2009, p. 5). It became prominent through the work of the Brundtland Commission which led to the defining of SD by Chambers (2011, p. 5) “As development that meets the needs of the present without compromising future generations to meet their own needs”.

Sustainable development was initiated as a result of conflicts between *social development*, *economic growth* and *environmental conservation*. At times, economic growth has been achieved through unfair deals; that is without taking into consideration the environmental consequences and the communities whose survival depends on the environment and the resources therein. Thus, sustainable development is defined as a course of action or development that focuses on environmental protection, while using the available resources to meet the current needs of the people without destroying or exhausting resources that will be needed to sustain the lives of future generations (intergenerational considerations). It is this, about bringing social, economic and environmental factors together (Meadows & Randers, 2012; Hart, 2013; Smit, Brabander & Martens, 2010). This study embraces the above definition because it spells out the move from environmental education to education for sustainable development. It can be said that the essence of introducing sustainable development is to dissolve the artificial boundaries between the environment, the economy and society. While people need to be educated about the environment through environmental education, it was also envisaged that some form of education needs to address the issue of sustainable

development. Therefore, the idea emerged in the early 1990s of education for sustainable development (Barraza, Duque-Aristizabal, & Rebolledo, 2003; UNESCO, 2004).

3.3 Understanding of EE

Environmental education should be integrated into any educational process (UNESCO, 2016) aimed at addressing practical problems of an interdisciplinary character that depend on the development of values. Those values can contribute to public well-being of the system by exposing people of all ages to the total understanding of the biophysical environment. EE should motivate learners to act in order to alleviate environmental problems.

Teachers should have certain characteristics. Teaching EE requires particular knowledge for teachers. EE should provide factual information on the processes in the ecosystem and the relationships among them. The knowledge base of EE comprises understanding of natural resources, that is their characteristics, distribution, status, and interrelationships, present and potential uses and forms. For teachers, the first level of understanding is related to understanding ecological principles, processes, interrelationships and human dependency on that system and should be included in their subject matter knowledge (SMK). Biophysical environment problems result from the interactions between man, culture and the biophysical environment. The second level of understanding by pre-service geography teachers should be the pedagogical content knowledge (PCK), which influences the teaching of EE to learners. A good blending of SMK and PCK gives the teacher a basis for teaching. Overall, a sound knowledge of ecological facts and correct teaching strategies can influence attitudes and encourage pro-environmental behavior. That expectation resonates well with Borhan and Ismail's (2011) affirmation of teachers as key agents in any educational change and reform. Further, Borhan and Ismail (2011) concur that teachers are positioned at the nexus of the intended change and the school itself. The above articulates well with findings of Kahle and Boone (2000) that teachers' possess definitive ideas about effective teaching strategies which can be employed to make EE effective as in their sequence of knowledge and understanding leading to new attitudes followed by behavioral changes.

Education can therefore be used as a tool to develop that knowledge and values consistent with environmental behaviour. Education is critical in promoting sustainable development and improving the capacity of people to address environmental and developmental issues (UNESCO 2016; Kopnina & Cosis, 2017). Many scholars acknowledge that understanding of EE has come about largely through experiential ways of learning (Sponarski, Vaske, Bath & Loeffler, 2016; Nazi & Pedretti, 2015). EE through ELT is

multisensory and has the effect of moving persons from lower to higher levels through Kolb's (1984) learning cycles as explained in the previous chapter. Kolb (1984, p. 38) emphasizes the essential characteristic of experiential learning as being:

- The involvement of the whole person (intellectual, sensory and emotional responses)
- An active use of all previous relevant life and learning experiences, and
- Reflection upon earlier experiences so as to allow an evolution of thought and gain a deeper understanding

3.4 Attitudes of teachers towards EE

Studies on environmental attitudes indicate that people with high levels of environmental knowledge tend to act more pro-environmentally (Kollmus & Agyeman, 2002; Chen et al., 2011). The concept of 'attitudes' refers to more than simply a body knowledge comprising factual information; it refers to a combination of factual knowledge and motivating environmental concerns which result in a tendency to act (Kendra, 2018). Many scholars acknowledge the influence on attitudes of motivational factors such as weighing the costs and benefits when to take action, availability of recycling facilities, interpersonal influence, government regulations and the quality of public transport (Poortinga, Steg & Vleck, 2004).

In summary, for EE to achieve its greatest impact on attitudes it must:-

- Provide factual information that will lead to greater understanding of the total biophysical environment, therefore, influencing attitudes. Knowledge of ecological facts such as how species in the ecosystem functions helps people fully understand and appreciate the need for conservation. People must have a total understanding of ecosystems.
- Develop a concern for environmental quality that will motivate citizens to work towards solutions for biophysical environmental problems. Development of the concern involves educating people about how humans can impact negatively on the environment that affects the quality of the environment to provide goods and services. Therefore, the development of concern is a process that starts from pre-school to university into informal education, EE is a lifelong education.
- Inform citizens as to how they can play an effective role in achieving the goals arising from. The attitudes of teachers towards the teaching and learning of EE is crucial. If teachers do not have sufficient knowledge, dexterity or desire to implement EE in schools, it is improbable that environmentally literate students will graduate from their schools. Cotton (2006) observes that the teacher provides the critical intermediary

element between the curriculum and the classroom. This resonates with Hameed's (2013) assertion that teachers are the implementers of any curriculum change; it is they who can decide on whether curriculum change is implemented in its true sense. In order for students to have sound knowledge and good values towards the environment, the knowledge base of the teachers themselves is of great importance as good subject and pedagogical knowledge is essential for best teaching (Borhan & Ismail, 2011).

3.5. Globalization and EE

Globalization refers to increasing cross-border movements of goods, money, information, ideas and people, with ensuing interdependency of people and institutions around the world (Wong, 2007). Globalization involves economic integration; the transfer of policies across borders; the transmission of knowledge; cultural stability; and the reproduction, relations and discourses of power. It is a global process, a concept, a revolution and the establishment of a global market free from socio-political control.

Globalization has resulted in rapid growth in world trade, foreign direct investment and cross-border financial flow. The advantages mentioned have been made possible and facilitated by international transportation, technology, telecommunications and the internet, without discounting the huge contributions by the World Bank, International Monetary Fund (IMF) and World Trade Organization, all devoted to an increase in trade and development (Wong, 2007). However, an analysis of the benefits globalization should not disregard consequent environmental damage. As such, global warming, deforestation, ozone layer depletion, biodiversity loss and pollution of oceans have been identified as being major causes of environmental damage (Osland, Dhanda & Yuthas, 2013). Such damage has been largely due to massive production by developed world to promote marketing of their respective products. The environmental impact has been greatest in relation to movement of Multinational Enterprises to countries where environmental laws are weak or absent or not enforced (Osland, Dhanda & Yuthas, 2013).

Through EE and ESD international laws have been developed giving guidelines on the use of the environment such as 'Natural Step Framework' which has largely been observed by the international corporations in the sustainable use of the environment, bearing in mind the three realms of sustainability as being ecology, society and economy, the Natural Step Framework (Wong, 2007; Osland, Dhanda & Yuthas, 2013) has precautionary principles that:-

- Substances from the Earth's crust must not systematically increase in the ecosphere.
- Substances produced by society must not systematically increase in the ecosystem.

- The physical basis of productivity and diversity of nature must not be systematically diminished going beyond the ecosystem's capacity for renewal.
- There must be fair and efficient use of resources with respect to meeting human needs (Osland, Dhanda, & Yuthas, 201; Wong, 2007; Toress, *et al.* 2002).

The principles outlined above so far reduced the extent of environmental damage globally. Therefore, EE has curtailed the problem to manageable levels.

3.6. Universities and Education for Sustainable Development (ESD)

Universities have long been mandated to advance the sustainable development agenda by a series of United Nations Earth Summits, namely the Stockholm conference in 1972, the Belgrade Charter UNESCO, 1975), the Thibisi Conference in 1977, the Johannesburg Summit in 1992 and the Talloitress Declaration in 2006 (Cortese, 2003).

Universities play pivotal roles in raising awareness among young people about sustainable development and developing core competences among graduates. Therefore, many institutions of higher learning have responded to a UN call to infuse ESD into their respective disciplines. The pivotal expectation of input from universities marks the universal acknowledgement of a wide range of skills and knowledge that universities are capable of developing. This is against the backdrop of realising that universities educate the next generation of decision makers (Chambers, 2011). Scholars such as Cortese (2003) and Schreiner, Henriksen, and Hansen (2005) are of the view that due to their social impact, universities are ideally positioned as multipliers of sustainable development principles. ESD could be systematically integrated into their institutional disciplines. Indeed, an increasing number of universities have since the onset of the environmental discourse has responded, and much progress has been reported. Notable examples for higher education (HE), according to Dawe, Jucker and Martin (2005) are that in the United Kingdom, SD strategy (2006) *Securing the future: delivering UK strategy* arguing that “SD principles must be at the core of the education system. In Wales Education for SD and Global Citizenship are parts of an action plan for mainstreaming ESD in HE. In Scotland the Scottish HE Funding Council encourages institutions to implement ESD initiatives and in Northern Ireland- Higher Education Partnership for Sustainability.

In the United States of America, government expected all federally funded universities to embrace sustainability in their educational settings (Sterling, 2010). In other parts of the world, universities have responded likewise to the call to adopt sustainability through research, campus management systems,

discipline based learning and infrastructural management (Ugwu, 2017; Bentham, 2015; Teise, 2013; Schrage, *et al.* 2015). In Australian universities a number of initiatives were carried out and sustainability as now a theme cutting across most disciplines (Tilbury, 2002, 2004). Similarly, the Association of African Universities (AAU) has supported the mainstreaming of environment and sustainability in higher education (Musarurwa, 2012; Lotz-Sisitka, 2012).

In Asia, “sustainability begins with teachers is an UNESCO Asian research program for education for sustainable development”. The Universiti Sains Malaysia became the Regional Centre of Excellence for ESD, where ESD is the new framework for education in response to the United Nations Decade for Education for Sustainable Development (UN-DESD). The idea of a Regional Centre of Excellence professes to transform the way teachers are trained to enable them to change the way they educate their students. ESD should be integrated into all curricula in support of the objectives of sustainable development (Dzulkifli, 2006 as cited in Esa, 2010).

“Sustainability starts with teachers” is a UNESCO international research action learning program of the Southern African Regional University Association. This program is spearheaded by Rhodes University in South Africa and the Swedish International Centre of Education for Sustainable Development. It supports teacher educators from nine Southern African Development Community (SADC) countries, namely Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe in setting up the exemplary ESD change project for SADC on behalf of the region, Africa and the international community (Lotz-Sisitka & Thshiningayamwe, 2017).

There have been, however, reports of barriers to successful embedding of ESD in many university disciplines in higher education; namely, overcrowded curricula, perceived irrelevance to academic staff, limited staff awareness and expertise, limited institutional drive and commitment and lack of academic rigor as traditionally associated with university disciplines (Dawe, Jucker & Martin, 2005).

3.7. Teacher Training in Zimbabwe

In the training of pre-service teachers in Zimbabwe, there is no policy from the higher education (HE) sector that guides the training of teachers at universities. The HE policy applies only at diploma level, where guidelines are provided by the Department of Teacher Education at the University of Zimbabwe through an associate status. This means the curricula at teachers’ colleges are guided by policy determined by the

University of Zimbabwe. Universities develop their own faculty regulations that will then influence departments to develop their courses and modules. In 1999, the Presidential Commission of Inquiry into Education and Training highlighted that universities operate through individual charters. Their charters define the key administrative structures for each university run by the University Councils (Nziramasanga, 1999). As the commission further observed, the administration of universities is decentralised from the institutions where university councils, faculty boards and other structures formulate, implement and monitor policy. However, the Manpower Act of 1990, 20:27 as well as university charters guides their work. Therefore, each university is entitled to and capable of developing its own range of modules where Environmental Science and Geography are included. This implies that in response to social needs, universities consider the Zimbabwe National Environmental Education Policy and Strategies (ZNEEPS, 2009), which is a product of previous Earth Summits, so that EE becomes part of their curriculum.

3.8. The Interdisciplinary Nature of Geography

Geography may be considered as the mother of all subjects. As shown in Figure 8 below, Human geography borrows from economic, social, political and historical geography.

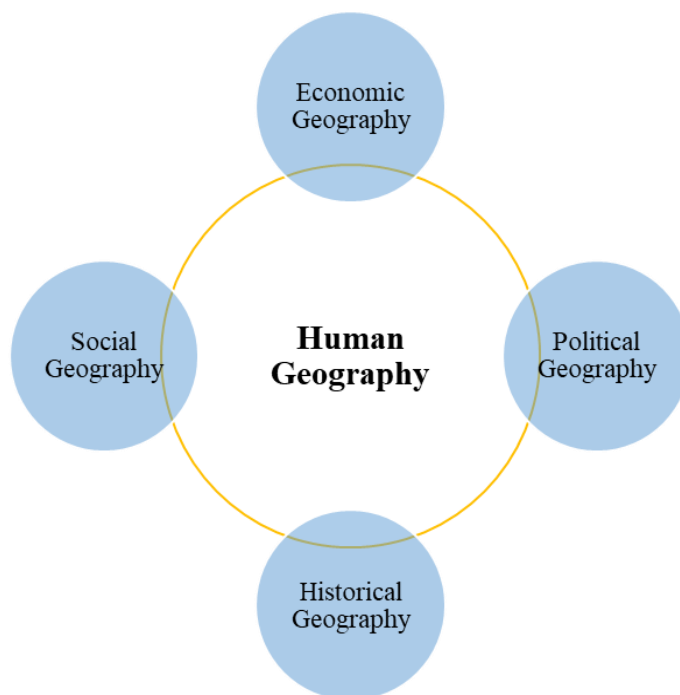


Figure 7 Interdisciplinary nature of geography (Source: Munowenyu, 1999)

All these disciplines contribute towards understanding of the human-environment interactions that shape human behaviour towards the biophysical environment (Munowenyu, 1999). Their contributions help us understand environmental problems from social, economic, political and historical perspectives. Therefore, environmental challenges have all the above aspects and help PSGTs to learn and creatively find solutions to environmental challenges

Social geography, as is shown in Figure 8 borrows from cultural, rural, urban and population geography. It means that solutions to environmental challenges are rooted in society and solutions have to consider above contributions to its distinctive nature in solving problems of society such as environmental problems (National Academy of Sciences, 2018). Environmental problems take place in a cultural context, influenced by its location, whether urban or rural, and quite so is the demographic influence.

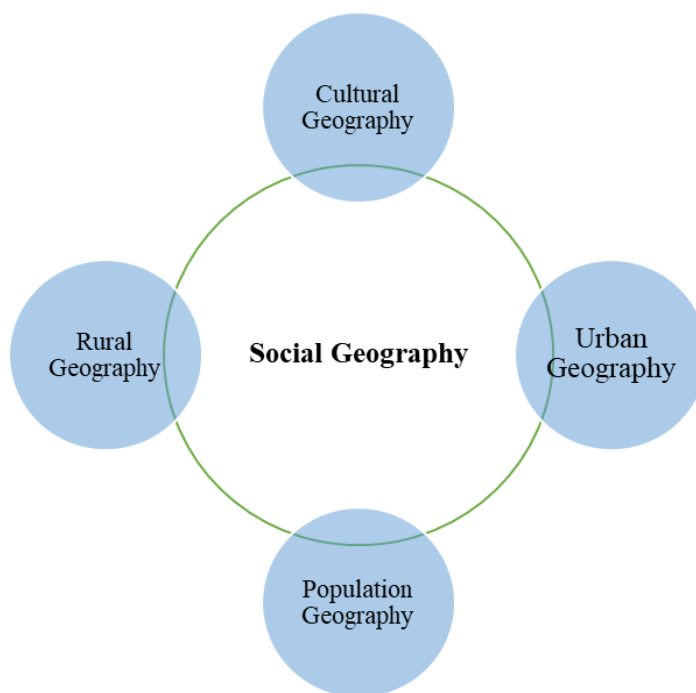


Figure 8: Interdisciplinary nature of geography (Source: Munowenyu, 1999)

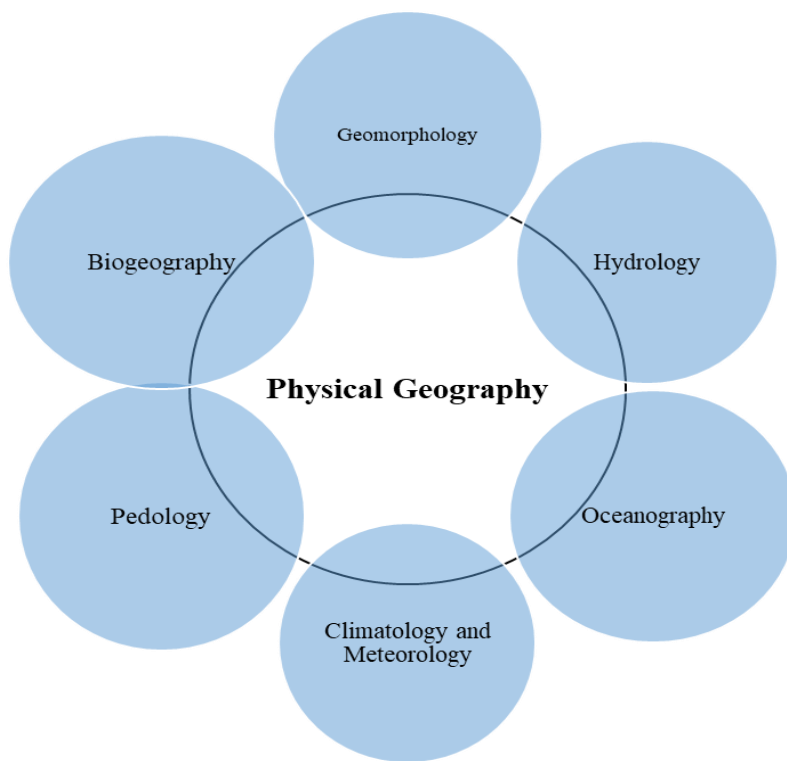


Figure 9 Interdisciplinary nature of geography (Source: Munowenyu, 1999)

Figure 9 refers to physical geography equal borrows from geomorphology, biogeography, hydrology, pedology, oceanography, climatology and meteorology. Understanding of natural processes that create the distinctive physical characteristics of each place is a pre-requisite for the preservation of nature through the cultivation of appropriate behaviour (Huggett, 2007). For example, problems of soils and soil degradation has to do with soil type, its characteristics and resistance to detachment under human cultivation. Origins of matter used as energy sources should be understood holistically. What human practices affect the availability of matter as sources of energy? Hydrology, along with water and marine pollution, are understood well if seen through the contributions of geography.

3.9. Zimbabwe's teaching of Environmental Education.

In Zimbabwe, as in many other countries, the approach to EE that has been adopted incorporates it into the primary and secondary school curricula, by integrating it into existing disciplines rather than offering it as a discrete subject (Mtaita, 2007). This approach of integration was adopted following the deliberations of international forums on how environmental education should be included into the school curriculum. In the Zimbabwean context, environmental education is available in high school subjects such as geography,

biology, agriculture and chemistry (Nziramasanga, 1999). This contributes to the significance of this study of exploring pre-service geography teachers' understanding and learning of EE at the Lowveld University in Zimbabwe. Pre-service geography education at the Lowveld University entails several modules that expose the teachers to environmental education, because according to official curriculum documents, they are supposed to teach about the environment, the impact of humans on the environment, conservation and the environment as a resource, in Geography for Forms 1-4 and Forms 5-6 (Curriculum Development, 2018). From these guidelines the teacher has to identify areas and stages in which specific content on EE can be integrated into the subject content. The teacher is expected to integrate EE by linking the subject content with different environmental challenges, and the environmental impact of those challenges. This process requires the teacher to have a wide knowledge base of environmental education, that is subject knowledge (SK), and also the skills of linking the subject content, that is Pedagogical Knowledge (PK), with the environmental education content without diluting the subject content (Kimaryo, 2011).

In some contexts such as Zimbabwe, integration appears to refer only to the teaching of content in the classroom. Nevertheless integration can also be achieved by taking the learners outdoors, even if the topic content is not directly related to the environment (Kimaryo, 2011). This simple approach to integration enhances learners' appreciation of the environment. In addition, environmental education for schools should go beyond the classroom into society, into their daily activities and into nature (Hua, 2004). For example, if school pupils learn about waste management in the classroom, to integrate what they have learned with society, they can discuss the impact of poor waste management on the environment, then decide to carry out a clean-up activity in their school, the area around the school and at home, all done through participatory action methods (<https://www.missouribotanicalgarden.org>) (Missouri Botanical Garden, accessed 20/11/18). The secondary education curriculum emphasises teaching and learning methods that make students active participants in the learning process (Kimaryo, 2011). It has been found that children learn better through the use of teaching methods that are active and participatory and are related to real life situations. Such methods engage secondary school learners in higher order thinking skills, critical thinking and stimulate learning, which are important in the learning of environmental education (Moon, 2000). This resonates with the tenets of ELT, as outlined by Nazir and Pedretti (2015).

3.10. Philosophical basis of Teaching Environmental Education

The traditional approach to the teaching and learning of environmental education focused on learning about the environment and environmental problems. As a result, teaching was mainly based on the transmission of cognitive knowledge (Alexandar & Poyyamoli, 2014; Kimaryo, 2011). In some aspects this approach was found to be deficient. It was assumed that when people received such knowledge, they would be able to take action in solving various problems in their environment and would therefore change their behaviour. More recently, there has been a shift from the provision of knowledge about the environment and environmental issues to carrying out investigations and taking action in the environment through experiential learning and participatory action research (PAR) (Torkar, 2014; O'Donoghue & Russo, 2004; Kimaryo, 2011).

In a response to the need for EE to bring about changes in behaviour, various models have been developed as tools for environmental learning (Howe *et al.*, 2009; Bui, 2011; Schools, 2013). One such model is that developed by Datta (2011), which is based on traditional thinking of assuming the behaviour of individuals can be changed if they are made more knowledgeable about the environment and its associated issues. It is assumed that the more knowledge one gets, the more aware of the environment one becomes, hence more motivated one becomes to act more responsibly towards the environment. O'Donoghue (2001) as a framework or tool for planning environmental learning developed another model. The model suggests that learners focus on an issue or a problem, then engage in enquiry, seek information, report ideas that they discover and then take action to solve the problem. This approach, which resonates with ELT and PAR, was applied to my study through the use of photo-narratives and reflective diaries as pre-service geography teachers engaged in internalizing environmental problems through ELT and made an in-depth attempt to solve the problem through PAR. The model developed by O'Donoghue (2001) seems to focus on solving environmental problems and issues. It is argued that it is not enough to simply teach learners about the environment and related problems but then fail to engage them in solving an environmental challenge facing the local community (Hicks & Bord, 2001). My study combined the O'Donoghue (2001) model.

An alternative model developed by Palmer (2002) on the teaching and learning of environmental education was based on the thinking that meaningful environmental education includes education about, in, through and for the environment. The elements of experience in the environment, concern for the environment and action-taking on the environment are crucial in the teaching of environmental education. Learners should be given the opportunity to get different experiences in their environment so that they can develop concern

and learn various skills needed for taking action in their environment through ELT and PAR. Therefore, meaningful environmental education has to include sourcing information about the environment to develop the knowledge base needed, exploring through experiences in the real environment, and taking action based on what one knows for a better world; all of which contribute to a better environment and sustainable environmental management (O'Donoghue, 2001). Emphasizing the central role played by experience in the teaching and learning of environmental education, Palmer (2002) stresses that "first hand experiences of the environment are at the forefront of teaching and learning" (p. 37). The model for teaching environmental education suggests that if the three components of environmental education, namely foundational, practical and reflective competencies, are taken into consideration, then the learners will become environmentally literate, develop concern for the environment and will develop action competencies based on environmental knowledge.

3.11. Environmental literacy

The Organization for Economic Co-operation and Development (OECD, 2010) defines literacy as the capacity that individuals possess to apply knowledge and skills in certain subject areas and to deal effectively with the problems, including the abilities to analyse, reason and communicate relevant information in their daily lives. Environmental literacy therefore refers to a person's capacity to perceive and interpret the state of the environmental systems and the appropriate action to manage, restore or improve those systems (Febriasari & Supriatna, 2017). Similarly, Orr (1992), as cited in Kimaryo (2011), defines environmental literacy as ecological literacy, which he considers to be the individual's capacity for knowing and caring about the environment and the ability to take action on the environment. He further says that environmental literacy involves an understanding of how individuals and societies relate to each other and also to natural systems. These definitions take on the three domains that are used to represent literacy. In this the cognitive domain contains knowledge of natural systems, environmental issues and action strategies. The affective domain consists of the components of environmental awareness, attitudes and values, while the behavioural domain includes the factors of intention, action, skills and environmental action experiences (Liu, Yeh, Liang, Fang & Tsai, 2015). This understanding from environmental literacy will enable an individual to identify problems emerging from the environment, and their causes, which require changes in the ways human beings relate to each other and to the natural environment.

From the preceding analysis, it can be seen that environmental literacy can be defined in terms of knowledge, understanding, attitudes and action-taking. Therefore, in order for an individual to be

environmentally literate, he or she has to have knowledge and understanding of the environment, develop positive attitudes towards the environment and take action to address issues or problems that may arise in the environment. Hence, in exploring pre-service geography teachers' understanding of EE and learning, the significance of this study was related to improving environmental literacy. One of the ultimate or primary goal of environmental education is to develop environmentally literate individuals. Knowledge about the different ways to protect the environment can enable people to act in a way which would maximise the effects of their efforts to address socio-ecological issues and risks such as waste management (Ketlhoilwe, 2013). For teachers to be able to address poor waste management, they need to be "environmentally knowledgeable, have positive attitudes towards the environment and show concern for environmental problems" (Esa, 2010, p. 40 as cited in Ketlhoilwe 2013; Turan, 2014; Markaki, 2014). Environmental education (EE) is now considered to be the most important instrument for influencing human behaviour towards more environmentally sustainable patterns (Markaki, 2014; Darnall, Henriques & Sadorsky, 2005). This is so because EE has been known to deliver benefits to individuals, society and the environment itself. Some benefits are improved health in the community (Mbokazi, 2016, Mind, 2007; Pretty et al., 2009), assisting with child development through natural play (Gill, 2006), and individuals gaining skills in communication and teaching (Storksdieck, Ellenbogen, & Heimlich, 2005). Wider benefits may include increasing the scientific literacy of the general public, which, it is argued, may in turn increase public acceptance of pro-environmental behaviour policies; there may also be practical improvements from restoring natural ecosystems through educational projects and increasing biodiversity of gardens (Evans *et al.*, 2005). The assumption behind running environmental education projects is that where participation involves contact with nature, this will increase appreciation for the environment, resulting in increased commitment and action (Ketlhoilwe, 2013). Thus, this education policy in particular could be a means of changing society.

3.12. Concern for the environment

Concern for the environment can be described as a feeling of care and responsibility for the environment. There are two sides to environmental education: firstly, the search for scientific and technical knowledge on how to manage and solve environmental problems and, secondly, helping individuals develop a sense of care and responsibility for the Earth (Mbokazi, 2016; Kimaryo, 2011). The development of such a sense of caring is referred to as environmental concern. For a long time, environmental education research has focused more on the search for knowledge and skills on how to manage and solve environmental problems,

but very little has been done in terms of the feelings and understanding that determine whether or not knowledge translates into action. This cognitive focus is based on several assumptions. The first assumption is that once a person is knowledgeable about a problem, he or she would automatically take action. Another could be the assumption that concern goes with interest leading to action. However, although concern and interest may lead to a person taking action on behalf of the environment, it may be presumptive to assume that action is indeed guided by the intention to act (Kollmus & Agyeman, 2002; Maiteny, 2002). Furthermore, concern for the environment can be merely concern for the welfare of humans, an anthropocentric concern, or concern for all living things, which is an ecocentric concern. One of the aims of teaching environmental education in schools is to ensure learners develop concern for the environment (Muranen, 2014; Desjean-Perrota, Moseley & Utley, 2008). Therefore, the teaching of environmental education has to influence both care and concern for the environment among learners. These qualities can be demonstrated by the individual's involvement in conservation activities, for instance proper waste disposal, energy saving, practicing green farming, and reading literature about the environment from different sources (Schusler, Krasny, Peters & Decker, 2009; Kimaryo, 2011).

3.13. Cognitive Domain in EE

An individual's response to the environment is based on three domains: cognitive, affective, and behavioural Kolb (1984). The cognitive domain of EE can be best considered to fall into three areas; namely subject content knowledge, pedagogical content knowledge and knowledge of context. The relevant cognitive strand of environmental knowledge, according to Morrone, (2001) has four components, as follows.

- a) Ecological principles and processes basic to comprehending the effect of humans on natural systems.
- b) Interrelationship among social systems and natural systems and the environment, and issues arising from these complex interactions.
- c) Strategies for environmental actions, including the ability to identify and critically evaluate alternatives for remediation (Morrone, 2001).
- d) Sufficient pedagogical content to teach students.

Summers, Childs and Mant (2000) argues that scientific knowledge is one important aspect of the complex knowledge base, apart from the pedagogical knowledge

3.13.1. Subject content knowledge

Subject content knowledge which can be called subject matter knowledge or content knowledge is defined as the “ecological concepts, principles, relations, processes and applications a student or pre-service teacher should possess within a given academic discipline, appropriate for his organization”: it functions as a source of knowledge to be transformed for teaching (Özden, 2008, p. 10). In the context of EE for pre-service geography teachers, these concepts are sourced from modules offered under the Bachelor of Education (Pre-service Secondary Honours – Geography) at the Lowveld University, such as Nature, Scope and Methods of Geography, Physical and Climate Geography, Aspects of Human Geography, Urban and Industrial Geography, Ecosystems and Environmental Management. Subject matter knowledge is also referred to as content knowledge (CK). This represents the source of subject content knowledge which becomes the basis of pedagogical content knowledge.

3.13.2 Pedagogical content knowledge (PCK)

Pedagogy is the science of teaching, instruction and training. Pedagogical content knowledge or PCK is defined as teachers’ ways of representing and formulating the subject matter knowledge in the context of facilitating student learning (Shulman, 1986). Thus PCK, represents a teachers’ understanding of how to help students understand specific subject matter; here concerned principally with EE. PCK includes knowledge of how particular subject matter, that is its topics, problems and issues, can be organized, represented and adapted to the diverse interests and abilities of learners and presented for instruction. It can be understood as content specific or subject specific pedagogical knowledge (Magnusson, Krajcik & Borko, 1999). The relationships between CK, PK and PCK are illustrated in Figure 10 below.

Teacher Knowledge – Starting Point

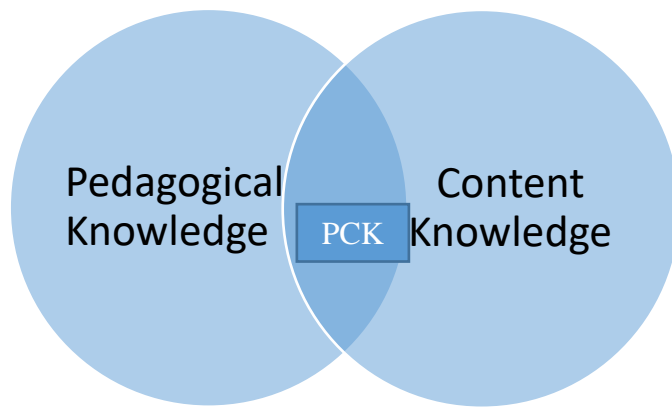


Figure 10 PCK components of Content Knowledge and Pedagogical Content Knowledge Source: Shulman (1986; 1987)

PCK represents blending of content and pedagogy into an understanding of how particular aspects of subject matter are organized, adapted, and represented for instruction. However, having referred to several studies by Shulman (Shulman, 1986, 1987) my observation has been the non existence of the affective domain in the models of PCK.

3.13. 3 Knowledge of context

In teaching, teachers have to work in a variety of ways to suit various situations, and also to adjust to the situations that they find in their classrooms (Marsh, 2014). Therefore, knowledge of context (KoC) is another facet of teachers' knowledge base that influences them in translating pedagogical content knowledge into instruction. Knowledge of context includes knowledge about the community, school, the learners' backgrounds, and the larger context of the district (Gess-Newsome, 2015) and also of the physical environment. Sometimes this knowledge is not readily available for the teacher, so he or she has to obtain it from the learners, parents and other sources (Barnett & Hodson, 2001). Knowledge of content and context helps teachers to contextualize the content being taught in order to make learning meaningful and related to real life situations. This contextualization is significant in facilitating meaningful teaching and learning of environmental education, that is, context specific environmental education. (Palmer, 2002, Mudaly & Ismail, 2016). Therefore, a teacher's knowledge of context is critically important in the teaching of environmental education. The teacher will only be successful in teaching if he or she has and uses knowledge of the context, because the learners' environment will form the core of his or her teaching. Many teachers fail to teach effectively due to lack of knowledge of context. Environmental problems are perceived

in cultural contexts, because they originate from different cultural contexts, and solutions come from multiple stakeholders within different social contexts. This therefore, means the teacher has to understand the multifaceted nature of environmental problems as part of the broader knowledge of context. In my study, for Research Question 3, PSGTs embedded their learning within the community context.

3.14 Affective Domain of EE

The affective domain in education, refers to education for personal social development, feelings, emotions, and morals or ethics (Brett, Smith, Price & Huitt, 2003). It refers to components of affective development focusing on internal changes or processes within individuals. EE should address the affective or attitudinal, domain rather only relying on cognition, because, as stated by Muchacha and Mthetwa (2015), knowledge alone is not sufficient to produce changes in attitude and subsequent behaviour. These authors further suggested that to address the values and attitudes necessary in developing environmental conscious behaviour, that the key entry point for EE is via the affective domain. Attitudes are feelings that generally have a moderate level of intensity, can be either unfavourable or favourable in direction, and are typically directed toward some object as a target. Hebe (2015) believes that EE should carry an affective component into all levels of the existing curriculum from early childhood through to university, so as to influence behavioural change that favours the environment. Environmental problems are largely social problems, and only to a lesser degree problems of science and technology. Gough and Scott (2007) further described environmental problems as social constructs influenced by human meanings. As social problems, they can be addressed by changes in attitudes at all levels of society, but firstly coming from teachers.

In summary the teachers' knowledge base is made up of pedagogical content knowledge (PK and CK) and Knowledge of context, all against a background that is the affective domain.

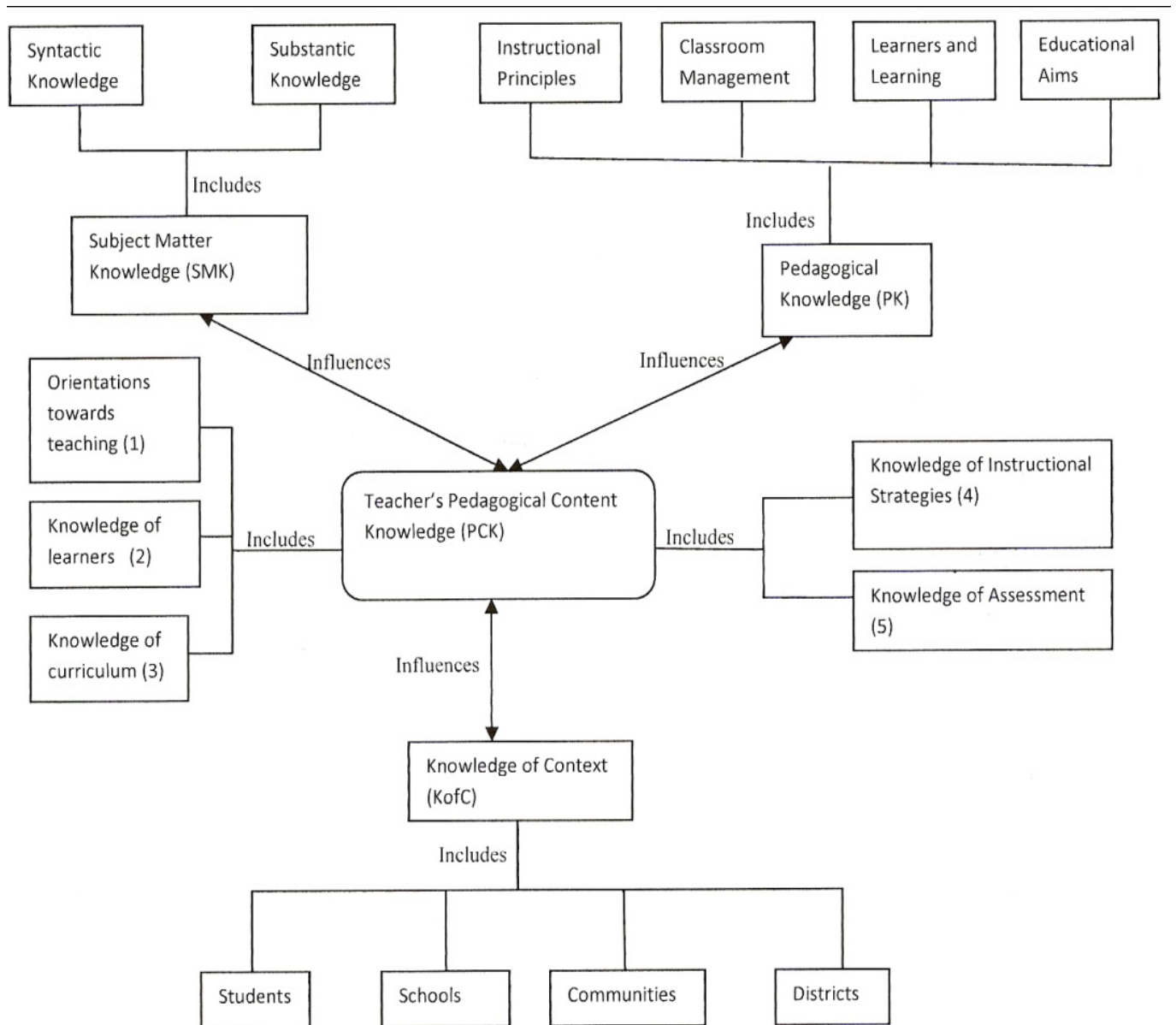


Figure 12 Teacher's Knowledge base Source: Shulman (1986)

PCK according to Shulman (1986) refers to the knowledge teachers use to translate particular subject matter to students, taking into account possible (mis) conceptions. Shulman went further to identify other components that are central to PCK namely: students' misconceptions or difficulties, instructional strategies and representations, task and cognitive demand, educational aids and media, content knowledge, context knowledge and pedagogical knowledge (Depaepe, Verschaffell & Kelchtermans, 2013). In the above model there is a complete absence of the affective domain which represents the teachers' disposition towards teaching. Teachers are more than subject matter specialists who deliver the subject matter, their feelings

are equally important. All this is evident in Shulman's (1986, 1987) models of teachers' knowledge base. Teachers' values and attitudes are crucial determinants of teachers practice (Hebe, 2015). Teachers practice is informed by their PCK. It is therefore vital that PCK be inclusive of the affective domain which has values and attitudes as key components.

Other scholars identified components of PCK namely Grossman (1990) such as knowledge of student's understanding, knowledge of curriculum, knowledge of instructional strategies and knowledge of purpose of teaching.

Mark (1990) also identified components of PCK such as knowledge of student understanding, knowledge of media for instructions, knowledge of subject matter and knowledge of instructional processes

3.15. Exploring studies on teachers' understanding of Environmental Education

This section of the literature review looks at studies of teachers' perceptions and understanding of environmental issues in society as a means of developing their environmental knowledge base. As a move from general studies about sustainable development and global sustainability, the trend in investigating teachers' views, is a good and welcome development; signalling that teachers are seen as key agents in curriculum change and innovation, especially on SD and sustainability.

A qualitative study by Summers, Kruger, Childs and Mant (2010) explored 12 primary school teachers' understanding of environmental issues, such as global warming, ozone layer depletion and the carbon cycle through interviews. The results showed a mixed understanding of environmental issues ranging from very low, through moderate to reasonable understanding. Further studies among teachers at Serbian primary schools Stanišić and Maksić (2014) found insufficient training for environmental education. Many studies acknowledge inadequate teacher training related to EE and ESD as being a major shortcoming of teacher education. In the Serbian case, problems had occurred during these teachers' education, where environmental and health education had not been sufficiently represented or developed. The authors indicate that further preparation of the teachers for teaching these topics could be a simple matter of additional training at seminars or on their own personal initiative, motives and activities (Stanišić & Maksić, 2014). Under such circumstances, it can be argued that teacher education and training on ecology, preservation of the environment and pedagogy at university level is a starting point for the successful realisation of environmental education carried through for younger. The problem with school pupils' lack

of environmental knowledge may lie with the teachers themselves. In this regard, a survey in the United Kingdom of 170 primary school teachers' knowledge and understanding of environmental issues revealed a considerable lack of understanding in areas such as the carbon cycle, global warming, and the energy exchange between the Sun, Earth and space (Summers, Kruger, Childs & Mant, 2010).

A comparison of teachers' knowledge and understanding of sustainability as needed to effectively teach the new domain of education for sustainable development (ESD) in a discipline based pedagogy was undertaken by Summers and Childs (2007). A questionnaire was used to solicit conceptions of SD from 21 Geography and 40 Science teachers. Results showed that the geography teachers had more substantial knowledge and appreciation of the centrality of the environment as the focal point of sustainable development than had the science teachers. This justifies the congruence of geography and environmental issues and that geography is the home of sustainability.

Another study on teachers' knowledge and understanding of sustainability and sustainable development was undertaken by Burmeister, Jacob and Eilks (2013) using a semi-structured interview with experienced secondary school chemistry teachers. The study established that the teachers were aware of sustainability, although most of them failed to give a correct theoretical definition of either sustainability or sustainable development. Respondents acknowledged the importance of implementing ESD into chemistry education despite their own knowledge deficits of subject matter, knowledge of sustainability and pedagogical content knowledge related to ESD in chemistry. This study once again highlights the need for sufficient subject matter knowledge and pedagogical content knowledge in respective disciplines that carry SD and sustainability.

Among two cohorts of pre-service teachers taking the Post Graduate Certificate in Education (PGCE) in the United Kingdom, Corney and Reid (2007) investigated the teachers' learning about subject matter and pedagogy in ESD, using proformas and interviews. This study reports on the teachers having subject matter content knowledge in geography but not having pedagogical content knowledge related to teaching geography while infusing ESD concepts. The need to relate subject matter knowledge with pedagogical content knowledge comes again to the fore and emphasises the close relationship between SMK and PCK.

Teacher attitudes towards and knowledge about EE among science teachers' in three international teaching communities in Bolivia, the USA and Turkey were explored by Campbell, Medina-Jerez, Erdogan, and Zhang (2010) using a questionnaire. Results showed significant differences between these three

communities with respect to teachers' knowledge about global environmental issues and teachers' rationales for including EE in their science classroom instruction. Although a global effect, environmental challenges are specific to a geographical location. Therefore, the environmental challenges being experienced Bolivia, as a developing country should be compared to those faced in the USA and Turkey, which could explain the differences in teachers' understanding.

Effective EE at university depends on having effective teachers. In this regard, Van Petegem, Blicke and Ongevalle (2007) used a questionnaire to assess lecturers and student teachers' environmental conceptions and awareness in three Zimbabwean teachers' colleges. Results revealed that not only student teachers but also lecturers confused certain environmental issues. One of the three colleges had better environmental programmes in its curriculum, especially in traditionally environmental related subjects of Geography, Chemistry and Agriculture. It means there is paucity on understanding EE in Zimbabwe. For this current study this indicates the importance of introducing students to different ecological and environmental issues in order to shift their orientation to actual commitment. In the Van Petegem et al. (2007) study it was found that outdoor experiential education for a sufficient duration influenced the adolescents' preferences towards the environment and nature usage (Van Petegem et al., 2007). Yavetz, Goldman and Pe'er (2014) measured the level of appropriate environmental behaviour among new students in three major teacher education colleges in Israel and found low level of environmental literacy of those teachers. This means that pre-service teachers need training on environmental issues as they progress in their studies using various methods as confirmed by longitudinal studies referred to above.

In the same study by Yavetz, Goldman and Pe'er (2014) on the student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies, it was found that the science disciplines of biology, agriculture, chemistry and geography were conventionally viewed as the most suitable disciplines for preparing environmental educators, because these subjects deal with topics of ecology, natural resources and issues related to human impact on the environment. This positions the current study that investigated pre-service geography teachers' understanding and learning of EE in the context of Zimbabwe's curriculum.

Differing contexts in local surroundings, degrees of industrialization and pollution in Zimbabwe, Europe, and USA might play an important role in shaping peoples' perceptions of the natural environment. The environment is a social and cultural construct wherein natural resources are defined as property of the poor (Korhonen & Lappalainen, 2004). In most societies the natural environment is regarded as the common

man's property, which defines their attitudes towards nature. Moreover, in Sothern African people's livelihood depends on the quality and availability of the natural resources (Lotz-Sisitka, 2012).

In Canada, teachers who were regarded as environmental educators were studied by Cordina and Mifsud (2016) and found to have difficulties in implementing EE at the conceptual level, the level of teacher responsibility and at the practical level.

Similarly, Cutter-Mackenzie and Smith (2003) claim that many primary school teachers in Queensland, Australia, appeared to be functioning with knowledge at a level they call 'ecological illiteracy'. They attribute this in part to EE being poorly represented in teaching training courses. Healey and Jenkins (2000) also reported on a perceived attitudinal hostility to teaching EE amongst secondary teachers, due partly to the absence of adequate preparation for engagement with EE. This deficit had caused feelings of disillusionment and disempowerment.

Summers ,Childs and Mant (2000) argues that scientific knowledge is one important aspect of the complex knowledge base, apart from the pedagogical knowledge with Yencken, Fein and Sykes (2000) arguing that environmental cognition involves belief systems and values apart from knowledge. Therefore, teacher development should embrace subject knowledge content and pedagogical content knowledge as well values consistent with environmental protection.

Many research studies across all sections of education have been concerned with implementing EE in elementary, middle and high schools, which then warranted the need for environmental literacy for teachers at university, as observed by Cutter and Smith (2001) and Cutter-Mackenzie and Smith (2003). These studies concluded that that high school teachers did not have sufficient knowledge about environmental issues such as acid rain, ozone layer depletion, greenhouse effect and renewable energy sources, as was later also indicated form studies by Spirpoulou, Antonakaki, Kontaxaki and Bouras (2007). Studies by Desjean-Perrotta, Moseley and Cantu (2008) revealed that elementary pre-service teachers had insufficient knowledge to be considered environmentally literate and therefore, during their teacher training, effective integration of EE (SK and PK) was necessary. A further survey study by Liu et al. (2015) used a questionnaire to survey teachers' environmental literacy and revealed that 50% of the surveyed teachers held misconceptions about global warming and biodiversity loss.

3.16. Attitudes related to teaching and learning of Environmental Education

Teacher's knowledge and attitudes are important in any educational reform or innovation, hence the significance of this study. Burmeister, Schmidt-Jacob and Eilks (2013) posit that effective educational reform will only occur when teachers' prior knowledge, attitudes and beliefs are considered. Knowledge, attitudes and beliefs act as filters through which new knowledge and experiences are screened for meaning. They affect how knowledge and intentions are operationalized in the classroom. Many scholars carried out studies with pre-service teachers in different contexts as are described next.

Yurt, Cevher-Kalburan and Kandir (2010) investigated the environmental attitudes among pre-service early childhood teachers, and found no significant differences between the attitudes of male or female respondents. It is clear that protection of the environment and having an awareness of the environment is the most significant duties of citizenship in the 21st century, irrespective of gender; both males and females are relevant in the development of environmental citizenry.

Another study concerning the perspectives of pre-service teachers on global warming was conducted by Orbay, Cansaran and Kalkan (2009) found that almost all the students believed that countries should coordinate their efforts against global warming, and they agreed on the precautions needed to prevent global warming. The implications of these studies is that the primary goal of EE, as applied in various countries is to lead individuals towards positive attitudes and behaviours (Yurt et al., 2010).

Regarding the attitudes of university students towards environmental problems, a study by Özmen, Çetinkaya and Nehir (2005) found these depended on a course on environmental education at all levels, primary school, high school and university. This implies that pre-service geography teachers should receive EE in order to be effective teachers when they finally leave university. Accordingly, this study intends to develop such a course for pre-service geography teachers so that they will be equipped with sufficient content knowledge and understanding of teaching strategies to reach their students in schools.

Moseley, Desjean-Perrota and Utley (2010) carried out a study on pre-service teachers' mental models of the environment using drawings as a way of analysing personal beliefs that influence pro-environmental behaviour. The results showed that the drawing defining the 'environment' were incomplete, therefore providing a basis to improve pre-service teachers' understanding of the environment and hence EE. The study's use of drawings to generate data shows that understanding can be explored through different methods besides cognitive definitions. These findings also reinforce the need to further develop pre-service

teachers' understanding of the environment and EE in experiential ways in order to influence behavioural change. It is also evident that tackling environmental problems using experiential methods such as, group work or field trips encourages deep learning and has a long term impact on the learners. Such methods also hold promise for teaching geography pre-service teachers.

Another exploratory study by Moseley and Utley (2008) on pre-service teachers beliefs about the environment, found that appropriate beliefs by teachers are a prerequisite to the effective teaching of EE. Likewise, so is understanding and learning of EE by pre-service geography teachers. Teaching beliefs shape teaching practice especially in the area of EE. Pre-service geography teachers, therefore, need to spend time and give attention to discussing the goals of EE as given in the Zimbabwe National Environmental Education Policy and Strategies (2003), which they will apply in the school curriculum, particularly in geography. Moseley and Utley (2008) further point out that teacher educators need to be explicit in the objectives and delivery of EE activities and curricula with pre-service teachers.

Yavetz, Goldman, and Pe'er (2014) investigated environmental literacy among pre-service teachers, concerning their attitudes, knowledge and environmental behaviour. This longitudinal study of students in three teacher training colleges showed that students' environmental knowledge was limited at the beginning of their studies, while their overall attitudes towards the environment were positive. Such a study reveals that environmental literacy among students of any level can be improved during training in areas such as EE. The study found that students majoring in fields specifically related to the environment were more knowledgeable and had more environmentally-oriented attitudes in comparison to students with other majors. The results of the cited study resonate well with the key research question of this study, concerning finding out understanding of EE among pre-service geography teachers. This will serve as a basis to develop pro-environmental behaviours among geography pre-service teachers at the Lowveld University. Individuals' environmental behaviours reflect their environmental literacy. Hence developing environmental literacy is equivalent to developing responsible environmental behaviour, and correspondingly individuals' behaviours reflect the level of their environmental literacy (Cole, 2007). According to Yavetz, Goldman, and Pe'er (2014) responsible environmental behaviour is a learned action; it does not develop in a vacuum but in response to interacting components.

A study by Perrota, Moseley and Cantu (2008) indicates that pre-service teachers' perceptions of the environment are not influenced by ethnicity, nor their dominant residential experience. EE in schools is seen as an important strategy for environmental sustainability (Taylor, Doff, Jenkins & Kennelly, 2007).

However, if teachers are to engage their students effectively in EE, it is a reasonable assumption that they should have an understanding and secure knowledge of key contemporary environmental issues and a positive attitude towards the environment (Cutter-Mackenzie & Smith, 2003). The studies cited above, across a number of countries indicate many instances of limited environmental knowledge amongst teachers, particularly so among pre-service teachers.

Phenomena such as rapid population growth, industrialization, urbanization, and exploitation of natural resources implicitly have a negative effects on the natural balance and so cause environmental problems (Yıldız, Sipahioğlu & Yılmaz, 2000). Global warming is the primary environmental issue encountered today. Global warming can be defined as the gradual increase in the Earth's surface temperature because greenhouse gases, such as carbon dioxide, methane, water vapour and fluorinated gases, allow radiation heat from the sun into the Earth's atmosphere but partially prevent the heat escaping back into space (Lynas, 2008). Global warming as a result of the greenhouse effect, which causes the climate system to change is the most important environmental issue which has emerged directly from human behaviour. Across scientific, political, economic and ethical fields it is a much debated question of the 21st century. Hence EE is most relevant for the young generation (Schreiner, Henriksen, & Hansen, 2005). Global warming affects not only the countries which cause the release of these gases but all regions of Earth. Many devastating natural events have been witnessed recently across several continents ranging from America to Europe, Asia and Antarctica. Examples include the increasing frequency and strength of hurricanes and typhoons in the United States of America and Japan, the rapid melting of glaciers at the poles, devastating floods in southern Asia and the destruction caused by massive forest fires in , which led to many deaths and a considerable material damage (Lynas, 2008).

Investment in EE is particularly important for Zimbabwe based on agri-based economy that presents a particular set of environmental challenges. The current study therefore is aimed at increasing the number of educated individuals who are aware of environmental problems such as global warming and help them develop solutions to prevent further problems. Therefore, an “environmental education investment” made for our children should be perceived as an investment made for the world (Bozkurt & Cansüngü, 2002; Yılmaz, Morgil, Aktug, & Göbekli, 2002). The Zimbabwean natural environment is agriculturally based; 70% of the population's livelihood depends on agriculture. This dependence results in a variety of environmental challenges such as veld fires, soil erosion, cultivation of marginal areas, cultivation of stream banks and deforestation. These challenges are geographically specific, soil specific, and nationally specific

to Zimbabwe. Fien (2001: p. 240 as cited in Holdsworth, Bekessy, Thomas, 2009) argues that sustainability education pedagogy must encourage educators to include the exploration of “questions, issues and problems of sustainability, especially in contexts relevant to them and their communities.”

3.17. The application of ELT and PAR in understanding and learning Environmental Education

The theoretical framework for this study comprises two models, namely, ELT and PAR, to illuminate the close link between understanding and learning. Many studies, as was shown in Chapter 2, clearly demonstrate the extent to which ELT has been used to influence learning and behavioural change in favour of the environment. This is because the ELT model portrays two dialectically related modes of grasping experience, concrete experience (CE) and abstract conceptualization (AC), and two modes of transforming experience, reflective observation (RO) and active experimentation (AE). The Figures below guided the literature review, showing to what extent people have been made to understand EE.

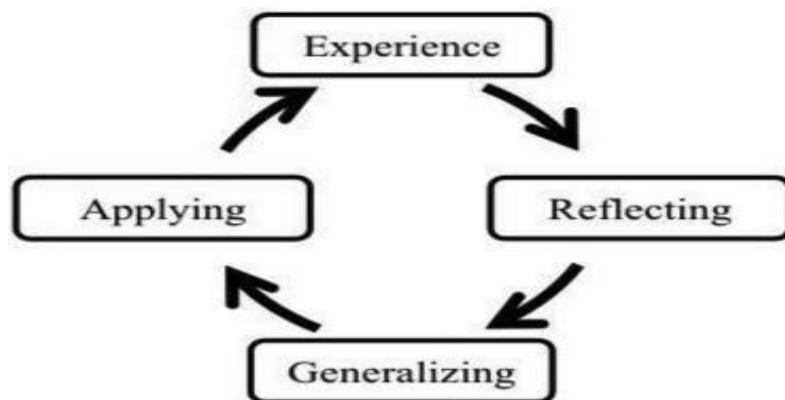


Figure 13 ELT and PAR (Source: Kolb, 1984)

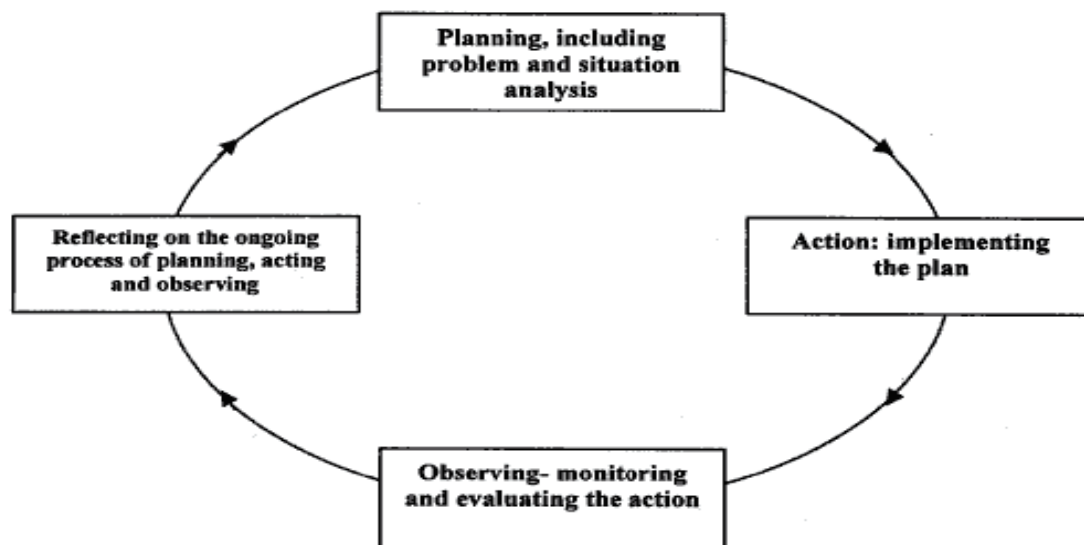


Figure 14 Action research cycle (Source: Hollingsworth, 2001)

Experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes as shown above in Figure 14. This means learning is subjected to all the constructs, a learning cycle or spiral exists wherein the learner “touches all the bases” of experiencing, reflecting, thinking and acting as a recursive process, which is responsive to the learning situation Kolb (1984). Knowledge so learnt or concrete experiences are the basis for further observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. It is the actions that precisely signal learning has happened.

The ELT model for learning is similar to the cycles encountered in PAR, which is defined as an approach to research that emphasises participation and action. It seeks to understand the world by trying to change it, collaboratively following reflection. PAR emphasises collective inquiry and experimentation grounded in experience and social history. PAR is a broad tradition of collective self-experimentation backed up by evidential reasoning, fact-finding and learning. Both ELT and PAR have several common features as are indicated next.

Participants in this study carried out studies of environmental challenges which were currently affecting urban areas, namely deforestation, water pollution, land pollution and sewerage bursts. The rationale behind this assignment was to help pre-service geography teachers understand environmental issues more fully, to apply ELT and through students' active participation help them internalize the need to create a clean environment.

Many of studies reviewed above did not extend to level of the current study and yet teachers play an important role in implementing EE programmes in schools (Liu, Yeh, Liang, Fang, & Tsai, 2015). Studies by Robottom & Graber (2000. p. 257) found that "behind every successful environmental education programme is a committed teacher". Therefore, among teachers, qualities of positive environmental attitudes, environmental sensitivity, and environmental knowledge and skills are a prerequisite to implementing environmentally based learning (Ernst, 2009).

Teachers are instrumental agents in the formation of pro-environmental attitudes (Said, Ahmadun, Paim, & Masud, 2003). However, insufficient teacher preparation has been identified as a factor in the weaknesses of EE efforts and an ineffective environmental education curriculum (Knapp, 2000; UNESCO, 2004). Accordingly, adequate EE preparation of students in teacher-training programmes is essential for helping future teachers design and implement effective EE in the classroom (Cutter-Mackenzie & Smith, 2003). The teaching and learning of EE is dependent, among other characteristics, on the teachers' subject matter knowledge, environmental literacy, pedagogical knowledge, methods of teaching EE, concern or attitudes towards the environment and knowledge of context.

The present study has distinctive features and contributes by filling a knowledge gap in many ways:

- 1 Studies have focused on university students and pre-service teachers in general
- 2 Yet due to its multidisciplinary nature, geography teachers are best placed to address EE
- 3 And although inadequate their knowledge of EE is often better than of teachers in other disciplines
- 4 Therefore, the study focuses on geography pre-service teachers
- 5 EE must be contextual and the Zimbabwe context is unique, but little is known about the teachers' competences
- 6 Research methods appear to have linked to questionnaires and interviews, with some drawings. I found no evidence of research methods like ELT and PAR.

- 7 The current study will fill the above gap where EE is best learnt and understood through ELT and PAR, where pre-service geography teachers are seen as key agents in the delivery of EE

3.18 Summary of chapter 3

This chapter has reviewed literature on sustainability at university level as a starting point and later on moved to a review of literature on teachers from primary school to high school. There is evidence of insufficient knowledge on EE on the part of teachers. The next chapter will look at research methodology of the study.

CHAPTER 4: RESEARCH METHODOLOGY

4.1. Introduction

In this chapter, I elaborate, explain and justify methodological approaches that were used to explore pre-service geography teachers' understanding and learning of environmental education at the Lowveld University in Zimbabwe. The chapter considers the following aspects of methodology: context of the study, structure of the study, paradigm, approach, the design (descriptive case study), location of the study, sampling, data generation techniques, triangulation, ethical considerations, validity and reliability, limitations of the study and end with a summary of the chapter.

4.2 Context of the study

The study was undertaken at the Lowveld University (pseudonym). The university has seven faculties and this study was carried out in the School of Education. The study was carried out in the Department of Teacher Development, which is responsible for training pre-service teachers for both secondary and primary education, leading to a Bachelor of Education degree.

Participants were drawn from Geography and Environmental Science clusters, where disciplines such as Biology, Chemistry, Physics, Agriculture, Art, Music, Shona, English, Ndebele, History, Home Economics, Accounting and Business Studies are studied. Participants were pre-service geography teachers in the second year of their teacher training studies. The modules which were central to this study were year two geography modules on EE namely Ecosystems and Environmental Management and Urban and Industrial Geography. This study explored PSGTs' understanding and learning of environmental education within the aforementioned modules, which give environmental knowledge.

4.3 Structure of the study

The methodological structure of the study, its location, approach, nature of study and methods of data generation are depicted in Figure 15 below. Thereafter, each methodological choice is explained.

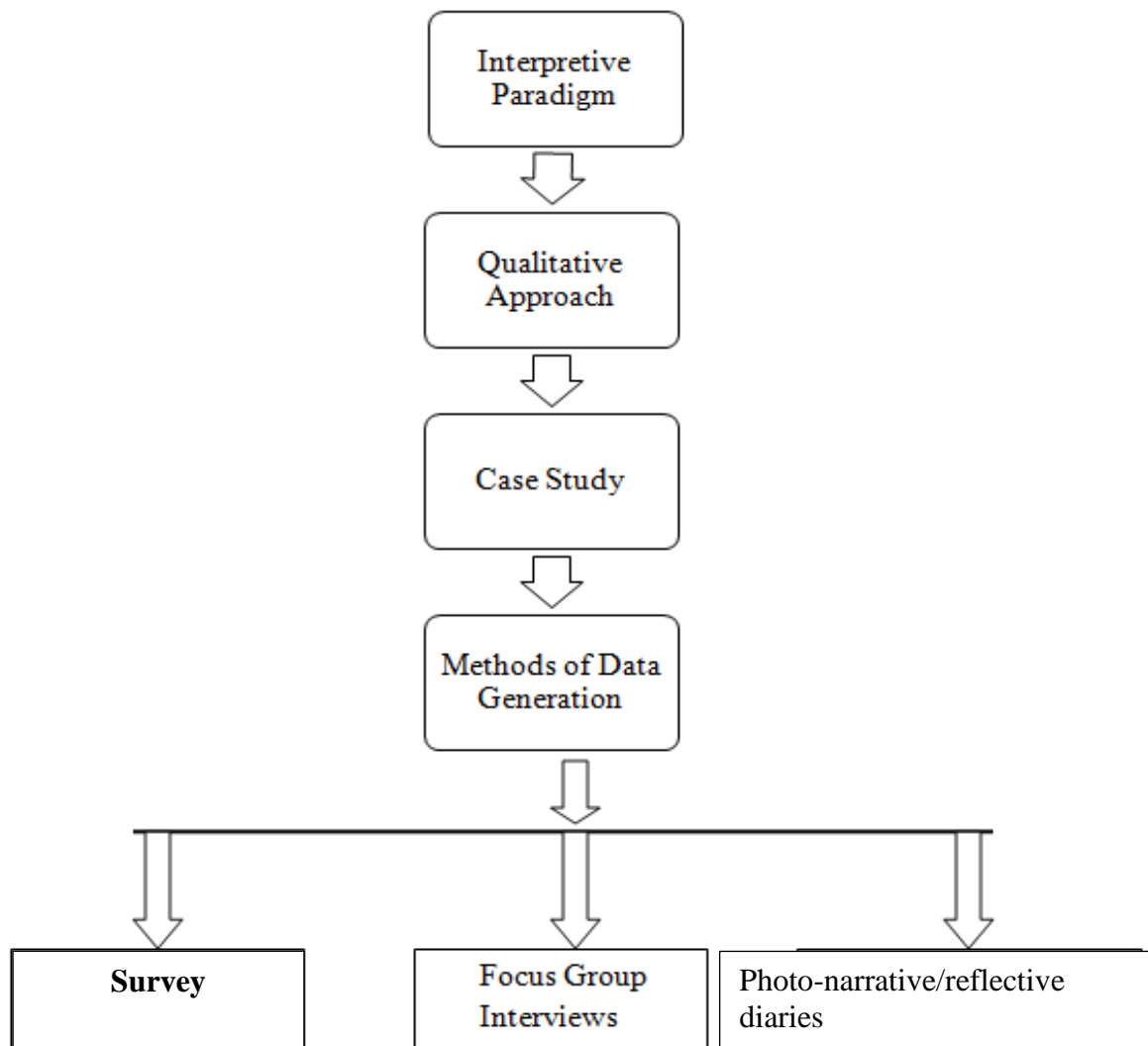


Figure 15 Representation of instruments and methods used in the study

4.4 Paradigm

Every scientific inquiry is inevitably framed within a paradigm, regardless of whether the researcher is conscious of this or not (Hammersley, 2012). A research paradigm defines and influence the research process and outcomes in several ways such as decisions to be made regarding the nature of the phenomenon explored, theoretical framing, literature, methods or research design (Hammersley, 2012; Hussein, 2015). A paradigm positions the philosophical thinking on what the researcher views as reality (ontological) and how the study should proceed (epistemological) and informs the treatment of the expected results in knowledge generation, which can ultimately improve human welfare. Scholars define a paradigm differently, but all

embrace the idea that a paradigm is a fundamental belief system or worldview that informs and guides the researcher (Barker, 2003; Descombe, 2010; Creswell, 2012; Walliman, 2011; Neuman, 2000). In this regard, Hamersley (2012, p. 2) sums up an research paradigm as a “set of philosophical assumptions about phenomenon to be studied (ontology), about how they can be understood (epistemology), and the purpose and product of research”.

The current study falls within the Interpretivist-Constructivist Paradigm (ICP). In the interpretivist paradigm, reality can only be interpreted through the meaning that participants give to their world, which can only be discovered through language. Interpretivism is associated with symbolic interaction, analytic induction and grounded theory (Schwadt, 2007). People construct meaning out of their experiences. It is this constructed meaning that the study is seeking. Reality in this context comes from the pre-service geography teachers who were the participants and data were generated through questionnaires, focus group interviews, photo narratives and reflective diaries. Hammersley (2012, p.57) asserts that the ICP emerged out of the realisation by social scientists that “people unlike atoms, chemicals or even non-humans forms of life interpret or give meaning and value to their environment and themselves, the centrality of the human being as the primary research instrument or source of views is important”. In this study, the interpretation of EE by pre-service geography teachers’ as their interpretation of reality was privileged. My role was a candid observer in the process.

4.5 Approach

Qualitative research methodology was used in this study as it sought a large amount of in-depth data from a small number of participants (Veal, 2005). A qualitative study involves getting answers or views from participants of the study (Creswell, 2013). According to Creswell and Creswell, (2017) qualitative research is a type of inquiry that uses different techniques in data collection, for example questionnaire, focus group interview and a portfolio of evidence, with the purpose of carrying out a realistic analysis of the data generated based on the notion that reality is socially constructed. It entails getting answers from the people themselves, about what they think of as reality, see as reality, feel as reality, and define as reality; the answers come in the people’s own words, hence the term qualitative (Creswell, 2012: 2013). The main characteristic of qualitative research, according to Creswell (2012), is that it seeks to explore a central problem and develop a detailed understanding of the central phenomenon (in this study PSGTs’ understanding and learning of EE) from the perspective of the participants (PSGTs). Thus, the role of the researcher is to provide a description of human experience as it is experienced by the participants (Creswell

& Creswell, 2017). Meaning is subjective, hence reality is defined by pre-service geography teachers through their responses to questionnaire, in focus group interviews and by portfolios of evidence; thereby allowing the essence of the situation to emerge (Cameron, Schaffer & Park, 2001). By using a qualitative approach, I was able to obtain a rich and in-depth understanding of how PSGTs' understand and learn EE. Thus, the study embraced a qualitative research approach.

4.6 Case Study Design

The study used a case study design. A case study is the study of a case within its real-life contemporary context or setting (Yin, 2009; Shuttlesworth, 2008; Cohen, Manion & Morrison, 2007). A case study is defined by Creswell (2012) as “an in-depth exploration of a bound system which could be an activity, event, process or individuals” (p. 462). In describing the underlying philosophies of case study research, Njie and Asimiran (2014) suggest that case study research is often grounded by the time during which data is generated or intended to be generated, the phenomenon and its context. The study took place from 2014-2017. This means that a case cannot be considered without its context. The context binds the case. In this study, the case explored is pre-service geography teachers' understanding and learning of EE. The context is limited to geography pre-service modules at a university in Zimbabwe.

Denzin and Lincoln (2011), Yin (2009) and Vos, Strydom, Fouche and Delport (2011) believe that case study research is not a method, but a choice of what is to be studied; a strategy of inquiry, a methodology or a comprehensive research strategy. The hallmark of the case study approach, according to Lapan, Quartaroli and Reimer (2011) and Cohen, Manion and Morrison (2018), is that the methodology provides thick descriptions of participants' lived experiences of, or thoughts about, and feelings for, a situation, using multiple data generation sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood (Baxter & Jack, 2008). Thus, using multiple data generation sources allow the researcher to converge the data in order to gain a deep insight into the case. The above authors Baxter and Jack (2008) further contend that the strength of the case study approach lies, firstly, in its being concerned with rich and explicit descriptions of events relevant to the case; its focus being on individual actors or groups of actors, seeking deep understanding of their views. The second strength is that the researcher is involved in the case, because the case study may be linked to the researcher on a personal or professional level. In this instance I am a teacher educator of geography at the Lowveld University.

According to Yin (2014) case studies may be categorised in terms of their outcomes, into exploratory, explanatory or descriptive case studies. An exploratory case study is a suitable means of eliciting information in order to seek new insights and clarify one's understanding of a process or problem. The exploratory approach provides new and detailed information or insight about a phenomenon through the research findings, which could inform policy or serve as the background for further research. Descriptive case studies focus on providing narrative accounts, while an explanatory case study would deal with hypothesis testing. Bearing Yin's classification in mind, this study embraces an exploratory case study design based on the purpose of the study, which was to explore pre-service geography teachers' understanding and learning of environmental education at the Lowveld University.

Case study design sets the parameters for sampling and suggests the methods of generating data. These two aspects are discussed in Sections 4.8 and 4.9.

4.7 Location of the study

The study was located at the Lowveld University in Zimbabwe. The Lowveld University is one of the eight state universities in the country. It is not the only university offering teacher education (BED) programmes in the country. It was established in 1999 as College of the University of Zimbabwe with a mandate to develop pre-service and in-service teacher education programmes suitable for Zimbabwe's primary and secondary schools. It is situated in the town of Masvingo in Masvingo Province, which is about 300 kilometres from the capital, Harare, as can be seen in the map in Figure 16 below.

The student enrolment has increased from the initial 2 000 students in 1999 to 14 000 in 2017, and is still increasing. The university has since 1999 grown from the single Faculty of Education to include Social Sciences, Commerce, Heritage Studies, Law, Arts and Natural Sciences and has now established multi-campus in Masvingo. The study was located in the Faculty of Education at the Robert Mugabe School' campus and houses several departments of Teacher Development (home of this study), Curriculum Studies, Special Needs Education, Adult and Continuing Education and Educational Foundations. The Department of Teacher Development develops Bachelor of Education pre-service (Primary and Secondary) teachers in many majors, of which geography is one. Students who enrol at the Lowveld University are post O level for the primary Bachelor of Education and post A level for the secondary Bachelor of Education. A few of these pre-service geography teachers (PSGTs) live at the university residence but the majority are scattered across town in rented accommodation, using shuttles to and from their residences and the campuses.

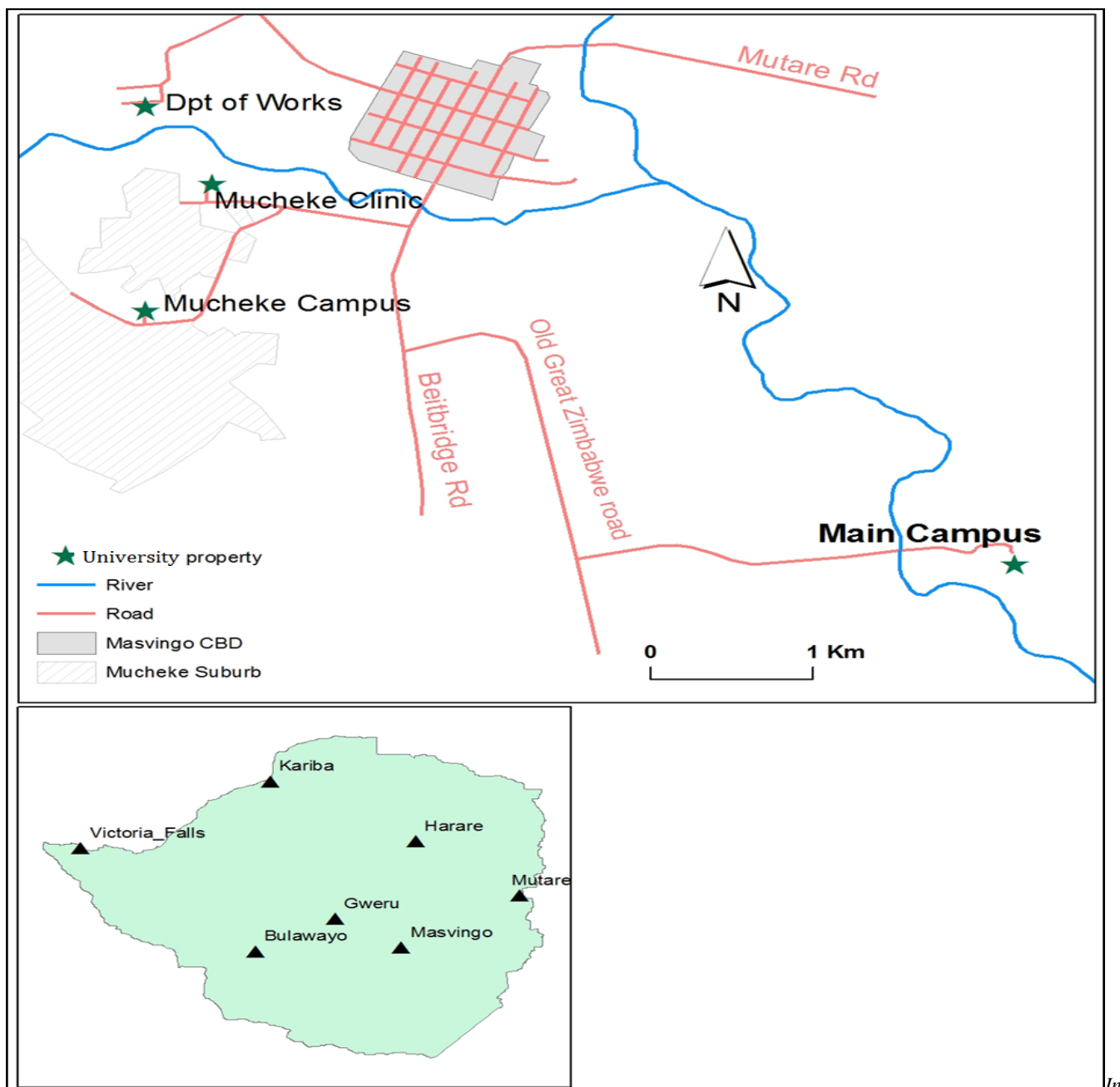


Figure 16 Map showing the location of the Lowveld University

terms of geographical location, the town is in a dry arid province most suited for cattle ranging. This is the home province of the Karanga tribe, who survive mostly by rearing cattle, with a few crops for subsistence purposes. Most students are from poor economic backgrounds and they have attended public schools in Masvingo.

4.8 Sampling

Sampling involves making decisions about which people, settings, events or behaviours to include in the study (Bertram & Christiansen, 2014). For this study, selection of participants was guided by my research design; the specified criteria of the case and the context required that participants had to be pre-service geography teachers. In this study, convenience and purposive sampling techniques were employed.

4.8.1 Convenience sampling

Sampling is considered here to be convenient because the study was conducted where the researcher is working as a lecturer. According to Etikan, Musa and Alkassim (2016) convenient or accidental sampling is when members of the target population meet certain practical criteria such as accessibility, geographical proximity, availability at a given time or willingness to participate at any given time. Darnyei (2007, cited in Farrokhi & Mahmoudi-Hamudbad, 2012) is of the view that the only criteria for convenience sampling is convenience to the researcher. This resonates well with the view of Bless, Higson-Smith and Sithole (2006, p. 172) who says that “samples so chosen are convenient for researchers in terms of time and money” In this case, the researcher had easy access to pre-service geography teachers at his university.

4.8.2 Purposive sampling

Purposive sampling, according to Cohen et al. (2018, p. 45) is used in order to access ‘knowledgeable people’ who have in-depth knowledge about particular issues by virtue of their professional status. Pre-service geography teachers were purposively selected on the following criteria, they had to be in the second year of the B.Ed. (secondary) teacher training programme. These participants had covered the two modules, Ecosystems and Environmental Management and Urban and Industrial Geography, within the geography curriculum at university, thus they could be expected to provide information on their understanding and learning of EE.

4.8.3 Sample Size

The twenty 2nd year pre-service geography teachers who were registered to study towards the B.Ed. (secondary) consented to participate in the study. Ten male and 10 female PSGTs registered for the year 2 module on EE participated in the study.

4.9. Activities undertaken in preparation for data generation

Pre-service geography teachers were informed about the study aim. They were also capacitated about ELT, PAR, and how to maintain photo narratives and reflective diaries.

The twenty year 2 pre-service geography teachers had been already exposed to content pertaining to physical and human geography in their lectures, they were also introduced to map work. They were taken on a guided tour of Masvingo's environmental hotspots and informed that they were going to be engaging with experiential learning and action research after the guided tour. They had been informed that they would need to work in groups, which they had self selected their groups prior to the guided tour. Four groups were formed, each with five members. For the guided tour PSGTs were provided with guidance notes, maps, a worksheet and survey questionnaire, which they were expected to complete.

After the guided tour each group of PSGTs were expected to identify an environmental challenge they wanted to study (see Chapter 7, Section 7.1. for greater details).

4.10 Data generation process

I generated data in three phases, using a survey, focus group interview, and photo narratives and reflective diaries on environmental problems and the resolutions of the identified problems. The phases were meant to allow pre-service geography teachers ample time to reflect on their responses before they moved to the next phase.

4.10.1 Phase 1: Survey

Kothari and Garg (2014) define a survey as a method of securing information about a phenomenon under study from all or a selected number of respondents. Surveys can either be census or sample surveys, "whatever, their type, the method of data collection happens to be observation, interview or questionnaire/opinionnaire" (p. 90). These authors add that quite often a questionnaire is considered to be the heart of a survey operation. Supporting this view, Gray (2014) believes that questionnaires are one of many research methodologies that can be used in combination with other data gathering tools such as interview. Gray (2014, p. 352) says that the "research design may plan for a wide-scale survey using questionnaires to be followed by up by in-depth structured interviews or observations with a target sample identified to be of interest by the survey"

The first instrument used to generate data was an open-ended questionnaire (see Appendix 5).

Open-ended questions, according to Cohen et al. (2011), make it possible and easy for the respondents to answer without any restrictions on what they wish to say. This makes it suitable for enquiring into complex issues, which demand more than just simple answers. A questionnaire was designed with the assistance of

university lecturers, to collect biographical data, as well as information on pre- service Geography teachers' understanding of EE, the value of studying EE, relationship between Science and EE, topics that can be studied in EE, their views' towards teaching EE , the possible enabling and constraining factors that will impact their teaching of EE . These questions were posed with the three research questions in mind.

The rationale for using the questionnaire as the first instrument of data capture was twofold. First, it allowed participants the opportunity to answer the questions privately, with the information written down by them in their own words. These aspects reduce the possibility of the researcher misunderstanding information and then misrepresenting it in field notes. Second it allowed time to reflect on answers before moving to the next stage.

According to Kumar (2011) an open-ended questionnaire as an instrument for data collection avails participants the opportunity to express themselves freely. In a similar vein, Cohen et al. (2011) maintain that a questionnaire is a means of eliciting the feelings, beliefs, experiences, perception, or attitudes of a sample of individuals. Tirivangana (2013) asserts that questionnaires have several advantages; namely, they are less expensive than the focus group interview, and the questions are uniform so each respondent receives the same set of questions phrased in exactly the same way and standardization where all items are highly and uniformly structured. These scholars' insights about the advantages of using a questionnaire influenced my choice of it being suitable for this study. A total of 20 completed questionnaires were collected from PSGTs (100 % return rate).

4.10.2 Phase 2: Focus group Interview

I used focus group interviews (see Appendix 6 for focus group interview questions) in the second phase of the data generation process. This approach was used in order to obtain rich information from pre-service geography teachers' on their understanding and learning of environmental education, because it would yield further information through an open dialogue with participants. A focus group interview is a form of qualitative research in which, among other objectives, a group of people are asked about their perceptions, opinions, beliefs, and attitudes towards a conduct, service, or concept (Cohen et al., 2011). Creswell (2012) asserts that focus groups can be used to collect shared understanding from several individuals, a small group typically consisting of four to six participants. According to Robson (2002) focus group interviews are used to generate and evaluate data from different subgroups of a population. By gathering data on attitudes, values and opinions, and empowering participants to speak out and in their own words, encouraging groups, rather individuals to voice opinions and providing greater coverage of issues than would be possible in a

survey. Although focus groups rely on interaction between the interviewer and the group, thus yielding a collective rather than individual view, one of the advantages advantage is being able to solicit more responses because participants interact more with each other than they do with the researcher (Robson, 2002).

Pre-service geography teachers self-arranged themselves in four groups (each group had five PSGTs) for the focus group interview. I conducted four focus group interviews that were of about ten minutes duration each. I made sure I established a rapport with the participants and asked non-intrusive questions in an acceptable manner, believing that the participants would be sincere. These focus group interviews were audio recorded. The benefit of audio recording is that participants can listen to their voices later and it can be used to validate their opinions. It can be used as a method of checking on validity and reliability in an attempt to establish rigor. I transcribed the audio recordings in preparation for analysis.

4.10.3 Phase 3: Photo narratives and Reflective diaries

The third phase entailed compiling photo narratives and reflective diaries. Each of the four groups of pre-service geography teachers maintained photo-narratives and reflections with explanations of their actions when they identified and solved local environmental challenges. As part of one of my lectures I capacitated PSGTs on how to create photo narratives (see Appendix 7 for photo narrative protocol) and reflective dairies (see Appendix 8 for reflective diary protocol). I also informed them what ELT entails and the stages in PAR in preparation of their field-based activity (see Section 4.9)

4.10.3.1 Using photo narratives and Reflective diaries as a research method

Photographs as a visual research method have always played a prominent role in geographic studies and social sciences. They show conveying a great deal of information (even hidden) about the appearance of a place far more succinctly than words (Rose, 2008; Hall, 2015; Pink, 2007a, 2007b; Rose, 2011; Tormey, 2013). The camera becomes an essential tool for human geography students and it is unthinkable to study human geography without photographic images (Hall, 2009). Furthermore, Latham and McCormack (2007) as well as Sanders (2007) emphasise that photographic research methods enhance students' observation and investigation skills, promote active creative engagements with environments, as well as facilitating reflexive engagements through review of photographs. Along similar lines Hunt (2014) and Phillips and Johns (2012) stress that photographic research expose students to new skills of research and presentation, different to the conventional methods. Scholars such as Kullman (2012) and Liebenberg, Ungar and Theron (2013) contend that photographic research methods offer alternative and creative ways of engaging with a

diversity of research participants through techniques such as photo-elicitation and interviewing. Rose (2008) further explains that photographs can be active players in the construction of a wide range of different kinds of geographical knowledge as they can be used for representation, evocation, as material culture and for illustrating what environmental problems look like.

The study borrows from photographing as a research method to illustrate various environmental problems that the focus groups identified in the community. Through several interventions the study showed visual representations of what the areas were like and to track environmental changes through several before and after photographs (Rose, 2008).

During stage 3 PSGT were required to take photographs and write a short narrative of the image captured on the photo. Photographs evoke meaning and reflections as well as information and factual data. They catch the texture, the mood, the atmosphere, and the 'feel' of real life environmental problems. They carry documentary and interpretive meaning, either posed or natural (Cohen et al., 2011). In photo-elicitation technique, the photography or set of photographs or sequence of photographs are used to invoke, prompt and promote discussion, reflections, comments, observations and memories (Banks, 2007). In this study the pre-service geography teachers studied environmental challenges through ELT and PAR and developed photo narratives based on their experiences in groups.

4.10.3.2. Reflective diary

A reflective diary is a tool that allows people to give an in-depth understanding of their learning experiences, as it allows for introspection and critical reflection on learning experiences encountered (Keke, 2008). In this context groups *identified, implemented, evaluated and reflected* on each intervention. These are in keeping with the constructs of ELT and PAR.

Each of the four groups was given a template that they used to document reflections based on their learning of EE (see Appendix 8). Some of the aspects participants reflected on were framed as questions.

4.11 Validity and Reliability

There are two concepts, namely validity and reliability that are traditionally used to judge the quality of any research findings.

4.11.1 Validity

According to Cohen et al. (2011) validity is the extent to which the research findings accurately represent what is really happening in the situation, in other words, whether the instruments explore what is actually intended. Moskal, Leydens and Pavelich (2002, p. 7) define validity as “the degree to which the evidence supports that the interpretations of data are correct and the manner in which interpretations used are appropriate”. This study addressed validity in many ways. Firstly, the instruments were verified by fellow researchers in the Faculty of Education at the Lowveld University to check for accuracy in order to enhance validity of instruments as methods for data generation. In this study photo narratives, reflective diary, focus group interviews and a questionnaire were used to capture pre-service geography teachers’ experiences and learning of Environment Education. These tools allowed for data to be triangulated, as indicated below in Figure 17.

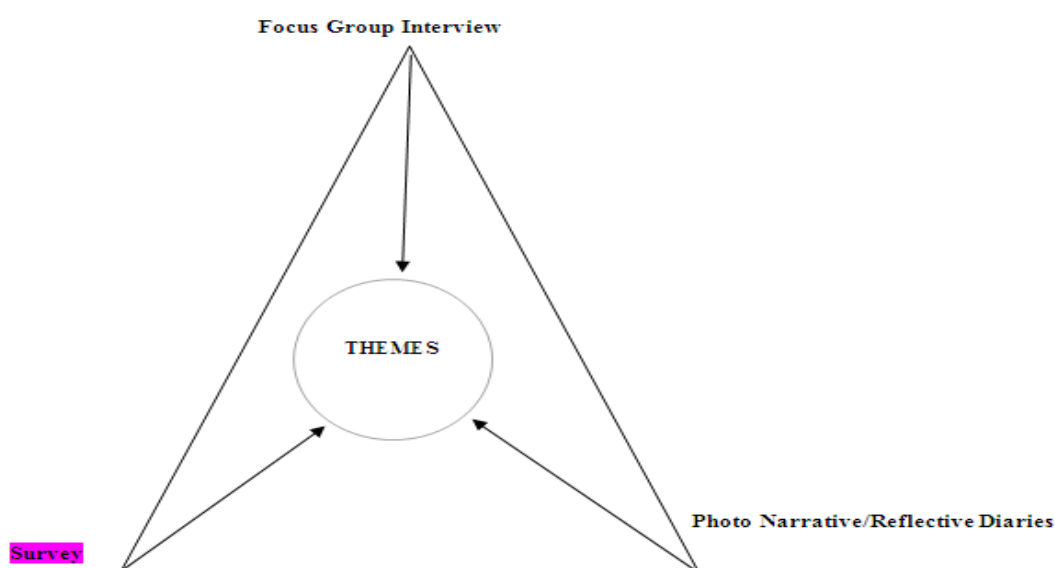


Figure 17 Diagrammatic representation of “triangulation” Adapted from Waters (2006) cited by Check & Schutt (2011, p. 267)

According to Creswell (2012, p. 259) “Triangulation is the process of corroborating evidence from different individuals, types of data or methods of data collection in description and themes in qualitative research”. Similar patterns are derived from data obtained from various methods, which brings greater precision and trustworthiness (*ibid*). Gray (2014) as well as Flick, Kardorff and Steinke, (2008) contends that for most

qualitative approaches, credibility is improved by and even guaranteed by triangulation, a cross validation strategy, that combines data drawn from sources at different times, in different places or from different people. The information that emerged from the multiple methods of data collection was as a result of the 20 pre-service geography teachers' construction of knowledge. "Active involvement through thought-provoking experiences and peer collaboration" (Tuckman & Monetti, 2011, p. 312) gave rise to the themes that provided answers to the research questions. Through collaboration and interactions knowledge was constructed.

Additionally, validity was also increased by requesting participants to read or listen to interview transcripts to verify the accuracy of data captured. According to Hancock and Algozzin,(2016); Ejimabo (2015) and Wentz (2016) this is referred to this as member checks, whereby data collected from participants and its tentative interpretations are taken back to the participants to see if the interpretations are plausible or ring true. Furthermore, in this study data were collected over a long enough period of time (12 months) to ensure an in-depth understanding of the phenomenon (Hancock & Algozzin, 2016; Ejimabo, 2015; Wentz, 2016) and this was also applied to photo narratives and reflective diaries where an environmental challenge was resolved after several interventions.

4.11.2 Reliability

Reliability is concerned with the findings of the research and relates to the credibility of the findings (Welman, Kruger & Mitchell, 2005, p. 145). Reliability is concerned with the question of the extent to which one's findings would be found again. According to Joppe (2000) and Chege (2011), reliability is about how consistent the results are when the experiment is repeated a number of times under the same methodological conditions; with greater consistency the instrument is said to be reliable. The findings of this study were credible because a number of data collection tools were used and thus data were compared across each other (questionnaire, focus group interviews and a report on the portfolio of evidence), peer examined and audit trailed where the researcher described in detail how data were collected and what emerging trends are evident. Joppe (2002) suggests that the audit trail should be detailed so that other researchers can use the study as further evidence or as an operating manual by which to replicate the study.

4.12 Data Analysis

The main goal in qualitative analysis is to organise data concerning the views of participants into meaningful set of patterns, categories and themes (Creswell & Creswell, 2018). Scholars such as Creswell (2013), Mouton (2001) and Cohen et al. (2013) consider that data analysis consists of the following tasks:

- Preparing and organizing the data,
- Reducing the data into themes, and
- Representing the data in figures, tables or discussions.

Whilst these three tasks were all undertaken in this study when answering the research questions, I was always aware that data analysis is not a linear process; it is as Creswell (2012) says “inductive”, “iterative”, “eclectic” and “interpretive”.

In preparing and organizing the data, the completed questionnaires were numbered from 1 to 20 before analysis could begin. The audio recordings of the focus group interviews were transcribed verbatim and transcripts were labelled as FGI-1 (for focus group 1) to FGI-4. Transcripts for the focus groups were sent to the corresponding groups for member checking. The essence of member checking was to ensure that participants expressed their views accurately on the phenomenon being explored, and to avoid my own misinterpretation. For the focus group interviews member checking was particularly important, because of the possibility of mishearing what had been said and to ensure respondents' views had been captured accurately. The portfolio of evidence were also numbered from 1 to 4 using A, B, C and D to represent groups A-D

The textual data were read and reread, which enabled me to immerse myself in the details in order to gain a deep understanding of each participant (De Vos, 2004) and note the content. In my study, as I analysed data from the FGIs with participants I began to notice new trends and patterns that also appeared in the reflective journals, making the process iterative and progressive. When I had analysed the photo narratives, my thought reverted to what participants had written in their reflective journals, in this way I was able to find a convergence between the two. Thus my analysis was recursive.

I used content analysis to make sense of the responses. According to Ezzy (2002), content analysis involves the organisation of the data into categories. This means that after repeated examination and comparison of the data, I noted consistencies and inconsistencies in the data and codes that emerged from the data. Similar responses were grouped together. I assigned a term or phrase that described the meaning of the textual data

grouped together. In other words, I assigned codes to each group of responses. According to Ezzy (2002), coding entails identifying themes or concepts that are in the data. Thereafter after many readings across the codes, I looked for links or connections among the codes to develop themes. Major themes were condensed into sub-themes to facilitate the analysis and reporting.

All visual data (photographs) were analysed on several levels. Visual analysis is an important step in evaluating an image and understanding its meaning (Peng, Wang, Wang & Qiao, 2016). To analyse the photo narratives I engaged in content analysis, visual analysis and analysis of contextual information.

In performing content analysis the following questions were asked when reading the photo narrative and video transcripts: What do you see? What is the image about? What are the individuals in the image doing? How are they presented? Can the image be looked at in different ways?

To engage in visual analysis the following questions were asked: How is the image composed? What is in the background, and what is in the foreground? What are the most important visual elements in the image?

When contextual information was examined the following questions were asked: What information accompanies the image? Does the text change how I see the image? How? What kind of context does the information provide?

Diverse explanations of PSGT understanding and learning of EE were analysed. How PSGTs learn EE was also analysed.

4.13 Limitations of the study

The study was carried out at the Lowveld University on pre-service geography teachers. Results of this study refer to the Lowveld University context with no direct reference to other universities in the same country. Therefore, results should be generalized to other institutions. The studies of environmental problems were located in Masvingo city which does not imply similar challenges occur in other cities.

4.14 Ethical considerations

Ethics refers to the system of moral principles by which individuals can judge their actions as right or wrong, bad or good. Social researchers are expected to conduct their research in an ethical manner because

research of any kind takes place within a social context (Creswell & Creswell, 2017). This justifies the need to introduce a moral perspective to the way the study was designed and conducted taking into account the moral, legal context and boundaries placed on topics of investigation (Cohen *et al*, 2018; Czarniawska, 2004; Bless, Higson-Smith & Sithole, 2006). In this section, the study addressed ethical considerations in as follows.

- Gatekeeper permission

The study sought permission from the Lowveld University via the Dean of the Faculty of Education on behalf of the Academic Registrar because the target sample was from the School of Education at the Lowveld University (See Appendices 2 and 3). Permission was sought from Masvingo City Council to study environmental problems in Masvingo. Ethical Clearance from University of KwaZulu-Natal was also obtained. This therefore meant that data generation process was guided by ethical standards.

- Informed Consent

Informed consent was obtained from each pre-service geography teacher participant in writing, with a clear indication that they could at any stage request termination or withdrawal from the research (Hopf, 2004; Gray, 2014; Descombe, 2010; Bless *et al.*, 2006; Czarniawska, 2004). Participants were informed at the outset that participation in this study was voluntary (see Appendix 4 for informed consent letter). The principles and rules developed by the Professional Association of German Sociologists and the American Sociological Association for ethics guided this study. These principles include among others, the following: (1) Avoid harm to participants/ damage avoidance (2) avoiding misrepresentation, deception/ fidelity/ breach of confidentiality (3) Respect of privacy of participants (4) Avoiding stress and discomfort (5) Avoid undue intrusion (6) Confidentiality of data.

The principle of informed consent means that research participants were provided with sufficient and accessible information about the study so that they could make informed decisions as to whether to become involved or decline (Crow, Wiles, Heath & Charles, 2006). Pre-service teacher geography teachers were provided with sufficient information during introductory lectures on the questionnaire, focus group interview and photo narrative and reflective diaries. Accordingly, gaining consent is said to yield important positive spin-offs (Crow *et al.*, 2006) such as increasing participants' confidence to participate in my study. Pre-service geography teachers had more

confidence in the study and therefore were more open and frank in their responses, improved their participation and the researcher was forced to sharpen and clarify the purpose and many issues in the study which enhances the researcher's skills.

- Confidentiality and anonymity

Welman, Kruger, and Mitchell (2005) mention that participants should be assured that they will be protected from physical or psychological harm by the use of pseudonyms. Pseudonyms ensure anonymity and confidentiality of participants. Pseudonyms were used in writing up of this study, for both the institution where the study was conducted and the participants. All responses were treated in a confidential manner. Ensuring that the ethical considerations mentioned above were adhered to gave the participant the confidence to share their views and experiences of learning about EE without fear of exposure. Moreover, this assurance contributed to a trustworthy environment, which allowed high levels of participation and openness during the focus group interviews. As a result, participants were quite willing to be involved in the study and saw it as an opportunity to share their experiences of learning about EE.

- Data use, storage and disposal

The data will be stored for a minimum of five years in a secure location agreed to by my research supervisor. All transcripts, photographs, questionnaires as well as the portfolio of evidence will be shredded using a shredding machine after 5 years. Audio recordings will be incinerated after 5 years. This written commitment was made to gatekeepers and participants.

4.15 Summary of the chapter

The chapter outlined the research paradigm that guided the study (interpretive paradigm), the nature of study (qualitative study), location of the study, sampling, types and sample size. The chapter looked at data generation methods such as the use of a survey questionnaire, focus group interviews and the use of a portfolio of evidence. Ethical considerations, accuracy, credibility, trustworthiness, validity and reliability and lastly phases of analysis of data sets were presented. The next three chapters will present the analysis of data in an effort to answer the three research questions.

CHAPTER 5: DATA ANALYSIS FOR RESEARCH QUESTION ONE

5.1 Introduction

In this chapter, the qualitative data generated through the questionnaire and focus group interviews are presented, analysed and discussed to answer Research Question 1, which is *What is pre-service geography teachers' understanding of environmental education?* As alluded to earlier, the sampled population were post A level students who were studying geography as a teaching discipline. To this end they had undertaken some university modules so could now be expected to respond to questions posed in the questionnaire and focus group interview on what they had learnt in relation to EE. This means that responses here are based on their learning at school and university.

I first present biographical data gleaned from the questionnaire. Thereafter, I present the five sub-themes that emerged from the data analysis from the questionnaire and focus group interviews. The themes are EE teaches people to conserve natural resources and use them in a sustainable way; EE develops understanding of human interaction and trade-offs with the environment; EE develops understanding of the Earth's processes; EE develops knowledge of skills in science and geography and EE promotes safe sustainable interactions. The chapter ends with a conclusion of the findings for Research Question 1.

5.2. Biographical data of participants

The biographical section of the questionnaire sourced information from the PSGTs in terms of gender, age, where they live and nationality.

Of the purposively selected second year PSGTs who were being trained as secondary school teachers of Geography, 10 were males and 10 were females. With regard to the gender it is worth noting, that studies by Ghosh (2014) and Banerjee & Das (2014) revealed no difference between male and female students on the level of environmental awareness. However, studies by McCright and Xiao (2014); Mohai (2014) and Merchant (2010) indicate that women show greater environmental concern or awareness than men due to how they are socialised. That is, on the one hand, women are encultured and socialised to be care givers, to be more compassionate, nurturing, protective and co-operative than men (Kurian, 2018; Strapko, Hempel, MacIlroy, & Smith, 2016; Taylor, 2010). Once internalized, this 'motherhood mentality', extends

to protective attitudes towards nature because females see themselves as embedded in their community and in the larger world. On the other hand, male socialization stresses being an economic provider role, which encourages them to be more rational, masterful, accumulative and competitive than women. The resultant male socialization into a 'marketplace mentality' which is linked to non-ecological attitudes that instead give priority to economic growth, technical mastery of the Earth and exploitation of resources regardless of environmental destruction (Hiramatsu, Kurisu & Hanaki, 2016 and Kalof, Dietz, Guagnano & Stern, 2002). Eco-feminist theory also holds that because of their reproductive and nurturing roles, women have closer ties to the natural world than do men. Women are symbolically associated with nature as opposed to men, who are identified with culture (Bell, 2015, Agarwal, 2000). I am, however, cognisant of danger of gender stereotyping related to men's and women's awareness of and proclivity to protect the environment. This current study that sought understanding from both male and female pre-service geography teachers is relevant and appropriate because it empowers both men and women to take future roles in environmental management.

Participants in this study were within the age range of 20-29. This means that, as young adults, they were within the formative range and still receptive new environmentally knowledge (Chawla & Cushing, 2007). Nearly all (95%) of the participants were from Zimbabwe. This means that these participants ought to be familiar with the contextual environmental challenges in Zimbabwe. The pre-service geography teachers in the study were urban residents from different parts of Masvingo Province. They emerged from small holdings, low density and high density areas. People in urban areas face a number of environmental challenges that should provoke a personal need to preserve the environment and became responsible consumers (Zimbabwe National Statistics, Zimstat, 2012). Problems such as the use of energy, the need for careful food choices (consumption styles) and responsible water use are constant reminders of the need to look after the environment through responsible environmental behaviour (Zimstat, 2012).

5.3 Analysis of data

Data presented in this chapter were generated through the questionnaire and focused group interviews. The data were collapsed into sub themes for the purpose of discussion and to derive meaning in response to Research Question 1. As mentioned earlier five sub themes emerged. For each of the subthemes discussed below, I present data from the questionnaire, and then relate it to data from the focus group interview.

Thereafter I present supporting literature. Lastly, after the presentation of the five subthemes I draw on the constructs of ELT and PAR to interrogate the data.

When recording the data excerpts, codes are used to represent participants, as follows:
Q,P5 = questionnaire, participant 5 FGI-2 P3 = Focus group interview 2, participant 3

5.3.1. EE teaches people to conserve natural resources for future generations

Twelve pre-service geography teachers considered EE as education that teaches people to conserve natural resources for the good of the present and future generations; hence making it education about intergenerational equity. Environmental issues such as climate change, soil erosion, siltation, pollution, deforestation, biodiversity loss, land degradation and poaching were all of great concern to the PSGTs because these factors affect the ability of the environment to continuously support human life. The notion that EE inculcates responsible behaviour came to the fore in the questionnaire responses and the focus group interviews. This understanding of EE is evident in the excerpts from the focus group interviews:

It has helped me to develop a sustainable and conserving mind and I now appreciate the need to conserve resources for the needs of the future generations (FGI-2P1)

Environmental issues affect me, I am more aware of for example soil erosion may lead to siltation of rivers which may result in drying up of dams which may in turn lead to water shortages resulting in drought, so I try to prevent soil erosion back home as top soil is rich in nutrient for plants (FGI-4P3)

Humans should be rational when dealing with environmental issues like pollution, erosion and deforestation to avoid environmental degradation (FGI-3P5)

The following excerpts from the questionnaires reinforce the responses from the focus group interviews.

It provides with understanding and knowledge of the environment which helps to prevent disturbance in nature for example soil, plants and animals (Q, P3)

People must think about others in the future, they must care about the earth when they use resources (Q, P15)

Natural resources should be used wisely to benefit current and future generations (Q, P20)

Teaching of environmental awareness creates good environmental behavior (Q, P2)

The above excerpts reveal that EE is seen as an avenue for promoting knowledge (*knowledge of the environment*) and developing responsible environmentally friendly behaviour (*creates good environmental*

behaviour, should be rationale when dealing with environmental issues, need to conserve resources) by using available resources in a sustainable way (*used wisely*). These components (*knowledge and pro-environmental behavior*) are considered to have a relational interplay, as alluded to by Bamberg and Moser (2007), who asserts that increased environmental knowledge increases concerns and awareness for the environment. Such concerns and awareness, according to Creech, McDonald and Kahlke, (2009), might lead to personal behavioural change. The above excerpts shows that the PSGTs believe that the environment supports human, plant and animal life, therefore, its preservation is necessary. The need to care for all beings (*plants and animals*) is highlighted in the given excerpts. Furthermore, these excerpts highlight the connection of humans to nature (*prevent disturbance*) and to sustainability (*conserve resources*). Thus, EE is seen as a vehicle for creating awareness (*provides with understanding and knowledge*) about environmental issues (*which helps to prevent disturbance*), which affect the availability of resources and the environments' ability to continuously support human life. EE develops values that are consistent with the preservation of and care for the environment (*prevent disturbance in nature for example soil, plants and animals*). The above excerpts resonate with views of Kopnina and Cosis (2017), and Rudd *et al.*, (2006) who observed that, because humans depend completely on Earth's ecosystem for clean air, food, water, climate regulation, spiritual fulfilment and their recreational benefits, they need to protect and care for the environment and all its components (living and non-living). Any disruptions in the environment or ecosystem will disrupt the flow of energy and negatively affect food chains and food webs. In this regard, Angelstam, Elbakidze, Axelsson, Dixelius and Törnblom (2013) and Jackson (2009) assert that knowledge of how ecosystems works is a prerequisite to their preservation, because knowledge empowers human beings to exercise caution in dealing sustainably with the environment.

Also explicit in the above excerpts are the PSGTs' concern for future generation regarding the environment (*they must care about the earth when they use resources*), the availability of resources for the future as well as how they are used at present. The notion that every generation is entitled to the use of natural resources comes to the fore via the excerpts (*think about other in future when they use resources*). The above perspectives of PSGTs concerning conservation of natural resources for future generations coincides with the words of Maathai cited by Kabiru (2011, online): "We owe it to ourselves and to the next generation to conserve the environment so that we can bequeath our children a sustainable world that benefits all". Furthermore, the ideas expressed in the excerpts above coincide with the theory of intergenerational equity put forth by Pearce (2014), who explains that humans are custodians of natural environment of our planet, thus as members of the present generation, we hold the Earth in trust for future generations. Pearce (2014)

further elaborates that as beneficiaries we are entitled to use and benefit from the natural environment but we need to consider how our actions will impact the Earth's resources and future generations.

All generations are equal in their normative position in relation to the natural system of which they are part. There is no basis for favouring one generation over another (Lauwers, 2016). Aligned to the theory of intergenerational equity, the 2015 UN Conference on Environment and Development emphasised that issues arising from economic and social development that impact on the environment ought to involve the participation of all the concerned citizens, at the relevant level, by ensuring that each individual has access to information, public participation in decision making and justice for environmental matters (Awan, 2013). In other words, economic and social development, alongside environmental protection, are deemed as being interdependent and mutually reinforcing pillars of sustainable development (Johannesburg Plan of Action, 1992). In the context of the theory of intergenerational equity, education for sustainable development (ESD) has come to define our relationship with other generations of our own species and our relationship to the natural system of which we are part. All this points to the protection and preservation of our environment for the good of human species and other organisms.

It was the intention of the current study to develop awareness, knowledge, attitudes and pro-environmental actions in pre-service geography teachers, which they could cascade onto learners at schools. Many studies have demonstrated that teachers' attitudes, knowledge and behaviour towards the environment affect and influence their students' attitude (Summers, 2000).

5.3.2. EE develops understanding of human interactions and trade-offs with the environment

A sizeable number of participants (25%) believed that there are many socio-economic benefits linked to the environment. These PSGTs believed that EE develops understandings of human interactions and trade-offs with the environment. Interaction comes in the form of human activities of agriculture, mining, tourism, fishing, among many others, in the context of providing raw materials needed in manufacturing, as evidenced by the following excerpts:

Through Environmental Management Authority I have learnt the dangers of deforestation to the environment and the dangers of polluting the atmosphere, we need to balance our activities so we don't deplete resources (Q,P7)

We depend on the environment for our survival be it farmers, fishermen, miners therefore we must think about our actions and how it affects the environment, we must care about our action on the environment (Q, P15)

Proper disposal of garbage, manage farming activities properly and manage the natural resources so as to avoid exploitation of them (Q,P9)

The following excerpts from the focus group interviews support the ideas expressed in questionnaire responses.

It is of concern because the expanding population puts pressure on resources calling for measures to reduce population growth (FGI-3P4)

It's important, we benefit from the environment ecotourism, mining, food, crafts therefore we must reduce and minimize overconsumption of natural resources when it's finished how do we survive (FGI-2P3)

The preceding excerpts highlight the benefits humans derive from ecosystems. It unveils an understanding of humans' dependence on nature (*we depend... for survival*) as users of ecosystem services as well as the need for care (*care about our action on the environment*) and conservation (*don't deplete resources*). There is a realisation that our dependency on the environment is not a neutral process; that it comes at a high cost with unintended risky environmental consequences (*when it's finished how do we survive*). In other words, there needs to be a consciousness of how human activities impact the dynamics of ecosystems (*balance our activities*) and how these changes in the ecosystem structure, their function and diversity, in turn will affect future activities and the range of services that humans use. Put simply, it means that our action (trading-off) and dependency on the environment destabilizes (*puts pressure on resources*) its balance and resources. These ideas imply that environmental sustainability (*balance our activities so we don't deplete resources; avoid exploitation*) is key for our socio-economic development (*ecotourism, mining, food, crafts*) and survival. Consumption of resources, including natural resources, generates a range of direct and indirect benefits for humans. The above excerpts signal the need to strive for sustainable development by recognizing the inter-dependence between the natural environment, and our socio-economic development (*minimize overconsumption of natural resources*).

The above data on human interaction and trade-offs with the environment correspond, with the finding of Galvani, Bauch, Anand, Singer, and Levin (2016); Hilson (2002); Mbaiwa (2003); Valle and Yobesia (2009) and Bwalya (2010). Hilson's (2002) study indicates that small-scale mining is pivotal role in alleviating poverty in many rural non-industrialised regions of the world because it is viable in remote areas with minimal infrastructure. Mbaiwa (2003) contends that Southern Africa is presently the fastest growing ecotourism destination in Africa. Ecotourism has been labelled the economy driver of the 21st century due to the multiplier effect of tourist spending, foreign investments, job creation, and infra structure

development, such as hotels, lodges, airports and airstrips, and tarred roads (Valle & Yobesia, 2009). Bwalya's (2010) study alludes to the role played by forests and woodland resources in the livelihoods of many rural poor households in mitigating conditions of poverty.

Tropical forests are home to more than half of the known world species. How the wildlife resources are managed to benefit the local population is therefore a critical question. CAMPFIRE (Communal Areas Management Programme for Indigenous Resources) is a Zimbabwean success story of wildlife management where wildlife resources benefit local people through the sales of meat to raise money for rural development, as described by Mbaiwa (2018) and Logan and Moseley (2000). These authors have observed that the programme aimed to reduce rural poverty by convincing local communities that wildlife is an asset that benefited them. Through this programme, wild animals are protected from poaching because wildlife became a resource that is communal owned by people and the benefits are shared by people. Projects such building of schools, clinics, hospitals and business centres came out of proceeds from CAMPFIRE in Zimbabwe.

In summary, the environment was construed by PSGTs as a source of socio-economic benefits via agriculture, manufacturing, forestry, mining, tourism and wildlife.

5.3.3. EE develops understanding of the Earth's processes

Three quarters of the PSGTs (16) are of the view that EE in the geography curriculum allows them to develop an understanding of the Earth's processes as can be seen in the excerpts below:

It refers to mankind's quest to know the origins of the Earth and the current process controlling it causing continuous change on minerals and geological processes (FGI-4P4)

EE components of geography teaches me to conserve the natural environment without harming it and leads me to understand how the environment is gradually changing globally and within my country (FGI-1P1)

Excerpts from the questionnaire endorse the above view:

EE as one of the sciences enables human beings to understand the surroundings and appreciate all processes which take place in the environment allowing them to draw conclusions and observations (Q, P1)

I have more insight on how our activities are responsible for climate change, global warming, deforestation, soil erosion, food insecurity (Q, P9)

EE is construed as a vehicle to raise awareness of and to sensitize PSGTs to environmental processes. An understanding of the interactions between humans and the physical environment contributes to an understanding of processes affecting the environment (*climate change, global warming, deforestation*) and encourages an interest in the management and protection (*conserve that natural environment*) of the Earth's resources. The above findings correspond with those of Anderson and Strecker (2012) and Tilbury (1997), which assert that EE in geography, which studies the interactions between humans and the physical environment, contributes to an understanding of processes affecting the environment and encourages an interest in the management and protection of the environment. Understanding the Earths' processes empowers human beings to exercise caution in dealing with the environment (*to conserve the natural environment*) in a sustainable way. Learning results in behavioural change and indeed leads towards the environmental conservation.

5.3.4. EE develops knowledge of skills in Science and Geography

Environmental education exposes and develops in PSGTs the skills needed in Science and Geography, such as observing, collecting, experimenting, comparing, and investigating, which form the platform for the development of higher order skills such as problem solving, evaluating, analysing and decision-making. These in turn lead to an informed responsible environmentally conscious citizenry. The following excerpts testify to these views.

It helps us understand how people interact (safe interaction) with the environment (FGI-1-P2)

It helped me in understanding geographical phenomena e.g use of scientific method like observation, experimentation, testing hypothesis and making sound conclusions and applying it to our local context by doing field work (FGI-2-P5)

It provides knowledge and skills in teaching EE and it promotes knowledge on sustainable development in Zimbabwe (FGI-3-P1)

It allows for map work skills, drawing, sketching (FGI-4-P3).

Excerpts from the questionnaire affirm the same views.

Teaching EE gives knowledge and skills that can give knowledge on sustainable development (Q, P6)

On understanding the environment and how it works, satisfying our curiosity, making observations, examining evidence, drawing conclusions and making new discoveries (Q, P4)

These are lessons on preservation of the environment which teaches people not to destroy nature by doing field observations and investigations (Q, P6)

From the preceding excerpts, it is evident that PSGTs valued environmental education for its practical solutions to local environmental challenges (*in our local context, in Zimbabwe*) by engaging them in tasks that involve observation, field work, experimentation, map work, problem solving and arriving at informed decisions and conclusions. The implications of the above excerpts are that EE programmes ought to create awareness of local contextual socio-economical-environmental issues or challenges by engaging learners in activities directly related to these issues in order for them to consider how to (re)solve these issues. Studies by Dube (2012), Hope (2009), Robson (2002), Fuller et al. (2003), Fuller, et al. (2006) and Boyle (2007) confirm that the fundamental principle of geography is that children develop understandings of the world through direct experience and activities such as fieldwork, in which scientific investigative methods are applied to features and processes in the environment. geography allows students including PSGTs to observe, measure and collect data, make predictions, engage with map work and sketches, test hypotheses and draw conclusions about places, events and phenomena (Kocalar & Demirkaya, 2017, Aldrich & Sheppard, 2000).

5.3.5. EE promotes safe sustainable interactions

Almost all of participants (17) in this study were of the view that understanding EE involves learning how to interact safely with the environment, as evidenced by the excerpts that follow.

It is about studying what is in our environment and using resources wisely so we don't harm the environment (FGI-3-P3)

It's a process of reminding people about better ways of interacting with the environment (FGI-4-P5)

A discipline whose main focus is to provide environmental awareness and for people to behave sustainably in their actions with the environment (FGI-2-P1)

The process of acquiring environmental knowledge and combating environmental damage (FGI-3-P3)

It is the study of environmental issues e.g environmental problem-solving and taking actions that improve the environment and resource (FGI-1-P3)

Excerpts from the questionnaire affirm the above responses:

It provides with understanding and knowledge of the environment which helps to prevent disturbance of the aesthetic value of the nature for example soil, plants and animals, It about education for sustainable development (Q, P3)

EE allows us to care for the environment and use resources wisely and stops us from polluting and destroying ecosystems (Q, P5)

It is when people are educated about how to protect and conserve things in the environment, concerning the legislation, pollution such things like throwing litter (Q, P17)

Information that helps humans to be aware in preserving and protecting the environment against other effects like erosion, pollution, and land degradation (Q, P18)

The excerpts above signal the dire need for safe sustainable human interactions with the environment (*don't harm the environment*). EE is seen as leverage for creating knowledge (*combating environmental damage, educated about how to protect and conserve things*) and awareness that would restrain bad habits (*like throwing litter, erosion, pollution, and land degradation*) among humans in their interactions with the environment (*better ways of interacting*). These PSGTs see EE as education for sustainable development that enables people to develop the knowledge, values and skills needed for their interactions with the environment. This means that EE teaches people to care for the world and the natural environment. Studies by Hooke, Martin- Duque and Pedraza (2012) and James and Card (2012) show how humans have altered and continue to alter the Earth's surfaces, mainly through agriculture, urban development, mining and construction.

It can be argued, that the knowledge gained via EE ought to influence the attitudes of people leading to pro-environmental behaviour as EE teaches people to care for the world and natural environment. Scholars such as Laidre et al. (2015) and Dietz *et al.*, (2015) assert that EE is 'values' education which develops environmental concern among people for all living/ non-living things in order to avoid harmful consequences to the biosphere.

5.3.6. Summary from the themes

From the above discussion, it is evident that EE is seen as a tool that helps to achieve sustainable development (Borhan & Ismail, 2011). The close interconnectedness between EE and education for sustainable development is illuminated in all the themes. EE cultivates decision making ability, critical thinking and problem solving skills. These attributes empower learners to participate in decision making and to ethically address the problems they might encounter in their daily life or environment. Thus,

environmental education develops an environmentally literate citizenry who can make choices that are better for the health of the environment, leading to a more sustainable planet.

5.4. Application of Experiential Learning Theory to the analysis

My analysis shows that EE is best appreciated by the application of experiential learning, which as explained in Chapter 2, and according to Kotti (2008), Fragoulis and Tsiplakides (2009) is a process based on the pedagogical principle of “learning by doing” as students acquire knowledge after having experienced or done something new. Kolb (1984) asserts that experiential learning or the act of doing encompasses concepts such as creativity, problem solving, decision making and attitudinal change. As mentioned previously in Chapter 2, the ELT model portrays two dialectically related modes of gaining understanding experiences, namely concrete experience (CE) and abstract conceptualization (AC) and two dialectically related modes of transforming experience, namely, reflective observation (RO) and active experimentation (AE). Learning arises from the resolution of creative tension among these four learning modes. As mentioned previously in Chapter 4, prior to data generation, PSGTs had attended lectures in preparation for a guided tour to Masvingo’s Environmental hotspots. Figure 18 below details the activities that PSGTs were involved in for each learning mode prior to the guided tour, during the tour and after the tour.

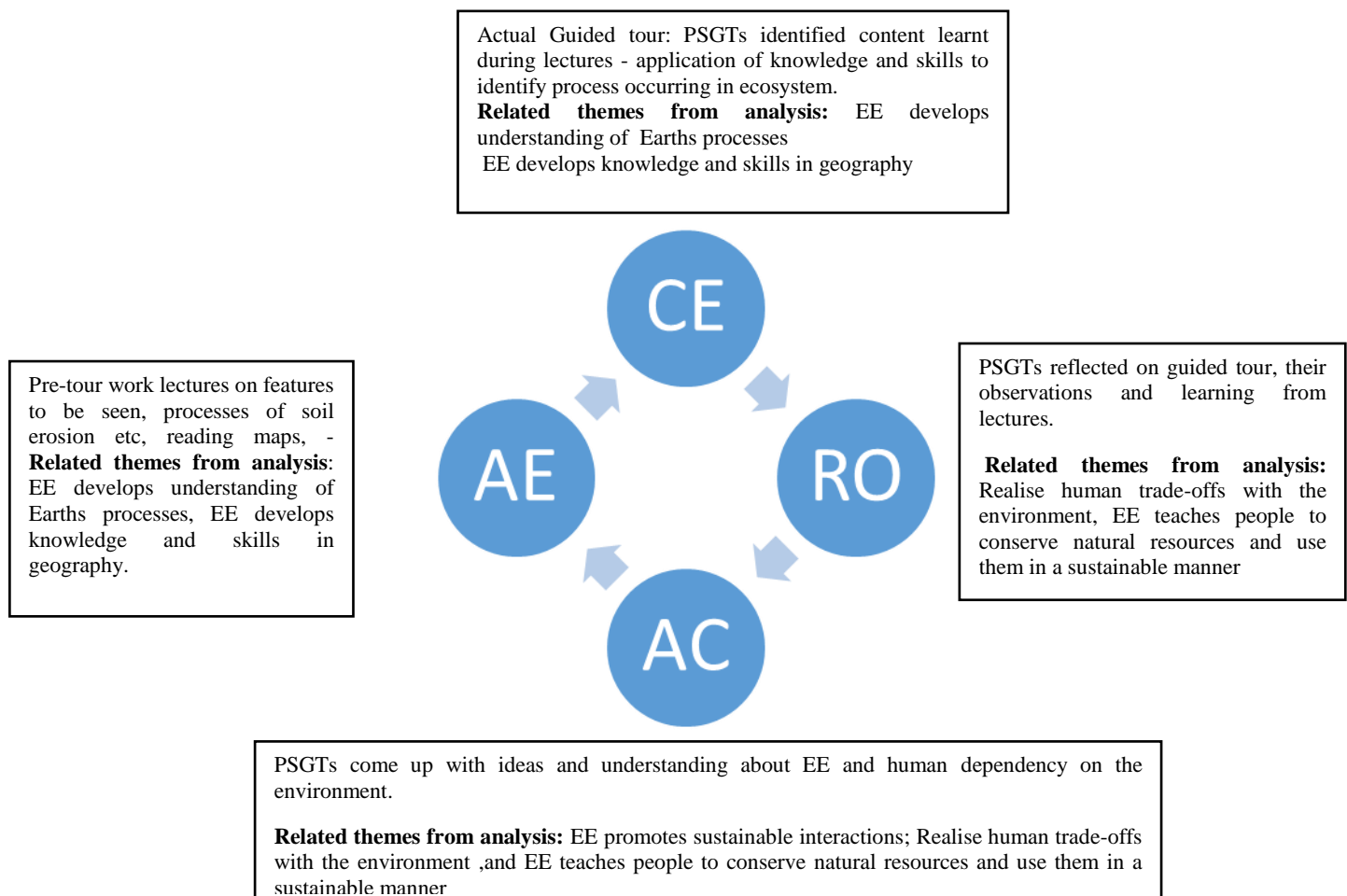


Fig 18: Pre-service Geography teachers' engagement in each stage of experiential learning and the associated theme from the analysis.

Analysis of the data related to Research Question 1 reveals that EE had enabled PSGTs to understand the Earth's processes such as soil formation, climatology, hydrology and the development of river systems (*appreciate all processes which take place in the environment*), as well as to develop skills in geography (*understanding geographical phenomena e.g use of scientific method like observation, experimentation, testing hypothesis and making sound conclusions and applying it to our local context by doing field work*). The aforementioned activities correspond with AE of ELT. During the CE phase of ELT, which corresponds to the guided tour of Masvingo's environmental hotspots, PSGT applied the knowledge and skills acquired during the AE phase (*On understanding the environment and how it works, satisfying our curiosity making observations, examining evidence*). During the RO phase PSGTs reflected on their learning and observations and arrived at a deeper understanding of the intricate relationship between humans and the environment (*I have learnt the dangers of deforestation to the environment and the dangers of polluting the atmosphere , allows us to care for the environment and use resources wisely*). In the AC phase of ETL, PSGTs came up with ideas to better understand human dependency on the environment. The learning acquired via EE results in behavioural change towards the environment and conservation.

The analysis of Research Question 1 brings to the fore the relational correspondence between EE and ELT. The application of ELT in this study is relevant because field based learning involves the application of learning in a real world context, which corresponds to the concrete experience phase of ELT, in that it sees learning as a process made of relearning through fieldwork. Sapkota (2017) observed that in its philosophy, geography attempts at understanding the dimensions of humans and their relationship with the environment through direct experience and observations. This view supports that expressed by Ondigi (2002) and Stoltman & Fraser, 2000; Baum (2012) who observed that geography is a practical subject that requires the use of strategies to give learners practical experiences to enable them to relate better to the environment.

In view of these arguments, the constructs of ELT and field work result in understanding where both postulates that learning is a sensory experience as reflected in Figure 19 below. It is stated that understanding gained through the application of ELT is similar to that derived from engaging in fieldwork (Fuller, *et al.*, 2006). Learning through fieldwork is experiential in nature. It means that, any reference to fieldwork essentially refers to ELT; the constructs are similar and achieve the same result, i.e. the development of understanding. In my study each of the four groups participated in fieldwork.

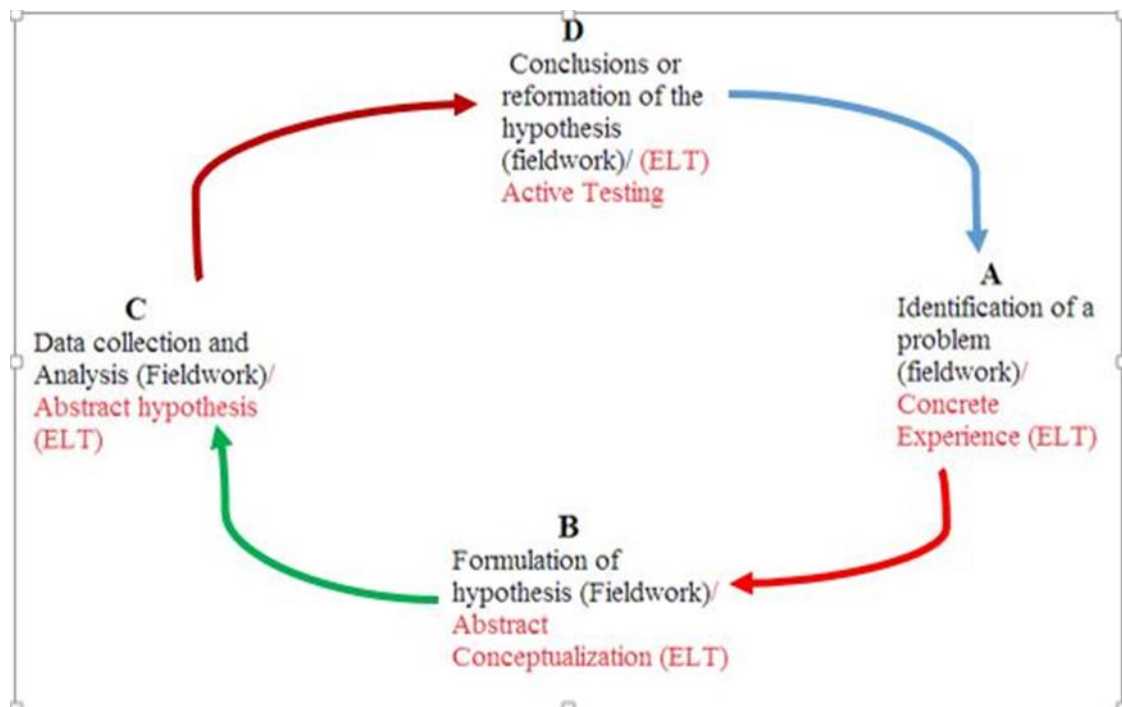


Figure 19 Experiential Learning Theory and Fieldwork from ‘A’ level syllabus 2015-2022

According to Jones (2015) fieldwork covers a range of constructivist and experiential instructional methods that truly engage students in learning through participatory activities (PAR) and reflection, especially through “learning by doing”. Studies by Hill and Woodland (2002) on the centrality of fieldwork found that knowledge and understanding acquired by students on fieldwork was individually constructed and assessment driven. In particular, field courses are seen to deepen experiences with place (Hope, 2009), broaden student learning (Wall and Speake, 2012 cited in Jones, 2015).

Consistent with expectations outlined in all levels of the geography curriculum (JC, O level and A level) a number of pedagogical benefits accrue to students as result of using fieldwork. These include the development of a range of subject-specific skills, such as mapping, data collection and analysis, as well as transferable skills, such as independent learning and problem solving (Sapkota, 2017, Shah and Treby,

2006). In addition, fieldwork can usefully encourage the development of interpersonal skills (Boyle, 2007). By touching on ELT constructs, fieldwork lends itself to the promotion of active rather than passive modes of learning and problem-based learning (Withell, & Haigh 2013; Waters, 2006). In relation to ELT, Healey and Jenkins (2000) have drawn attention to the role of active experimentation in Kolb's (1984) experiential learning cycles by connecting student learning from the environment through fieldwork. Theory and practice interrelate in a spiral of teaching (Fuller et al., 2006). If geography is taught through fieldwork, it can indeed develop environmental sensitivity in pupils from lower secondary, undergraduate and postgraduate levels. Yurt, Cevher-Kalburan and Kandir (2010) are of the view that children, from their earliest and formative years, should experience active learning in an environment where they can use all their senses; they see, touch, hear, observe and wonder, and test (multidimensionality of sensory learning). This can be evident through the influence of geography throughout their lives.

It can therefore be concluded that fieldwork is conceived as the “signature pedagogy of geography or hallmark of geography education” (Hovorka & Wolf, 2009, p. 99); as intrinsic to the discipline as is clinical practice to medicine (Fuller, 2010). Geography is the home of sustainability, geography has traditionally been viewed as the ‘torch bearer’ of sustainable development education (Robson, 2014). However, there has been little work evident in the literature reviewed in Chapter 3 that directly engages with the role of geography in shaping environmental citizenship for students of the discipline, particularly pre-service geography teachers, hence the significance of this current study.

5. 5. Summary of Chapter 5

The chapter focused on Research Question 1, which is, *What is pre-service geography teachers' understanding of EE?* In this study it was established that geography teaches people to conserve natural resources for the present and future generations, develops understanding of the human-environment interactions, develops understanding of the Earth's processes, develops skills for science and geography and helps develop safe and sustainable interactions. The next chapter will look at Research Question 2 and consider the pre-service teachers' attitude towards teaching and learning of EE, with respect to enabling and constraining factors affecting teaching and learning EE.

CHAPTER 6: ANALYSIS OF DATA FOR RESEARCH QUESTION 2

6.1 Introduction

This chapter presents and analysis data from the questionnaire and focus group interviews to answer Research Question 2 and two sub-questions. For the overarching question *What are pre-service geography teachers' attitudes towards teaching of Environmental Education?* one theme emerged; specifically, that Teaching EE is important, with two subthemes concerning knowledge and skills gained by learners. For the first research sub-question: *What factors enable the teaching of environmental education?* two themes emerged that enabled teaching environmental education; viz, Adequate teacher knowledge (CK) and Positive teacher attitudes. Concerning the second research sub-question: *What factors constrain the teaching of environmental education*”? again two themes emerged, which were Inadequate training related to PCK in EE and Lack of resources. In the next sections I present the themes and subthemes for each research question with corroborating evidence. Firstly data from the questionnaire is shown, which is then supported by data from the focus group interview, thereafter I present relevant literature findings. Lastly, after the presentation of all the subthemes I draw on the constructs of ELT to interrogate the data for further insights.

6.2. PSTGs attitude to teaching and learning EE: Teaching EE is important

PSTGs adopted a positive attitude towards teaching of EE. This was based on their valuing EE for its potential to enhance learners' knowledge and skills concerning the environment and knowledge of sustainability and conservation.

6.2.1. EE Gives learners knowledge of the environment, SD, EE and ESD

Pre-service geography teachers valued and stressed the importance of EE by revealing how it gives learners knowledge of the environment and sustainable development, as illustrated in the questionnaire excerpts below.

Teaching EE can help students to gain knowledge of how to interact symbiotically with the environment which cause no harm to the surroundings, they will learn to conserve, protect and use resources wisely so the next generation can also have resources (Q, P3)

Initially learner will learn about ecosystems, the interdependence of biotic and abiotic factor, impact of man's activities on these factors and this knowledge will help them and their community to protect, preserve and conserve the environment, resources and live sustainably. (Q, P8)

If you do not apply what is learnt in EE we will have nothing, we will have famine, disease, no water, we will destroy the environment and ourselves ,it will be the end, we MUST conserve our resources (Q, P9)

The excerpts from the focus group interviews support the above views.

Including EE in geography lessons is an advantage, pupils would know how to protect the environment, use resources sustainably and wisely find ways of conserving the environment (FGI-3-P5)

EE provides knowledge on how human beings can coexist with nature e.g living with plants and animals without disturbing the ecosystem, respecting and caring for all forms of life for harmony (FGI-4-P1)

It is important to teach EE because pupils are able to keep the land clean and do reforestation (FGI-1-P2)

Participants believed that teaching of EE is important because learners are given knowledge on a variety of topics in the environment and SD (*will learn about ecosystems, the interdependence of biotic and abiotic factor, impact of man's activities on these factors*). Gaining adequate knowledge on the environment and sustainable development helps people to sustainably manage the environment (*use resources sustainably and wisely*) by implementing better ways of interacting with nature (*respecting and caring for all forms of life*). The knowledge gained via these topics arouses awareness (*they will learn to conserve, protect and use resources wisely*), serves as reminders that bad environmental habits damage the environment (*we will have nothing*), impact the availability of resources (*use resources sustainably and wisely*) and threaten our existence (*it will be the end*). The notion that humans share the Earth with other organisms is explicit in the excerpts above (*can coexist with nature*), therefore there is a greater urgency (*we must conserve our resources*) to create conditions that allow other forms of life to grow and thrive (for *harmony*). This

envisaged action on conservation referred to in the preceding sentence can be achieved through acquiring knowledge that restrains humans from acts of pollution, deforestation, climate change inducing activities, overfishing and causing forest fires, among the many human activities that negatively damage the environment. In a way, PSGTs believe that learning EE ensures learners are empowered with knowledge needed to make decisions that are critical to ensuring the world has the natural resources on which our economy and quality of life depend. As future citizens, learners gain knowledge on the environment and SD in order to address environmental issues, as well as adopt practices that shape the course of future environmental policies. The above finding is consistent with those of Roczen (2013) and Frick, Kaiser and Wilson, (2004) who argue that knowledge on the environment and SD is essential to encourage people to avoid harmful behaviours and activities that endanger resources and other organisms.

6.2.2. EE gives learner's skills to deal with environmental challenges

EE builds the knowledge and skills needed to address complex environmental issues as well as to take action to keep our natural world healthy, our economies productive, and communities vibrant, as is visible in the teachers' opinions shown in the excerpts below:

Field based learning on EE allows for observation, investigations, critique, problem solving of existing challenges in one context, to resolve environmental issues, learning about EE gives skills needed to address environmental issues like pollution, soil erosion, deforestation. Learners get to work in group to address issues and work together...(Q, P5)

Exposure to nature activities in social studies allows learners to learn about care and conservation of resources it allows them to reflect on man's actions towards the environment (Q, P17)

The above expects are supported by data from the focus group interviews.

EE imparts skills to learners on how to deal with contextual issues they encounter daily: overgrazing, deforestation, pollution, soil erosion It help in creating awareness, problem solving , taking action and reflecting on it (FGI-3-P2)

It equips learners to problem solve day-to-day environmental issues in their communities (FGI-1-P1)

Environmental education provides important opportunities for learners to become engaged in real world issues that transcend the classroom. It affords learners the opportunity to apply their classroom knowledge to identify, observe and solve complex environmental issues confronting our planet.

Geography is the description of the Earth. Therefore, all geography topics are related to the physical Earth (Holt-Jensen, 2018; Craglia, Goodchild, Annoni, Câmara, Gould, Kuhn, Mark, Masser, Maguire, Liang, & Parsons, 2008). As explained in Chapter 3, the interdisciplinary nature of geography includes topics such as biogeography, geomorphology, landforms like mountains: hydrology, water sources and catchment management; thus environmental management, and human impact on the environment are common geography themes. Studying such topics can impart skills in learners, which they can use to deal with problems such as overgrazing, pollution or soil erosion. These skills enable learners to solve day-to-day environmental challenges (Gakuo, 2016). Overall, learners become better informed about the interconnected relationships of actions such as deforestation and erosion, or marine pollution and health of fish (Karatas & Karataş 2016). All these sustainable activities will ensure future generations have continued access to resources in the same way that present generations enjoy them. Such knowledge allows learners and communities to continuously plan measures to mitigate environmental challenges (Shiwaku & Shaw, 2008). Ability to mitigate in this way comes from environmental knowledge, which should be holistic in nature (Gakuo, 2016). The above findings resonates with the views of Palmer (2002), who observed that studying the environment involves education ‘about’, ‘through’ and ‘for’ the environment. Most themes that are covered in geography should be studied in this way to produce an environmentally informed person. For example when mountains exist in the environment, teaching geomorphology should not rely merely on a model (Butler, 2013; Brown & O’Hara, 2003; Crang, 2013). Geography as subject must involve fieldwork so as to allow learners to observe phenomena first hand and reflect on their observations, as in the application of experiential learning theory (Colin, 2010). As the philosopher Benjamin Franklin said in the mid 18th century: “Tell me and I forget, teach me and I remember, involve me and I will learn”.

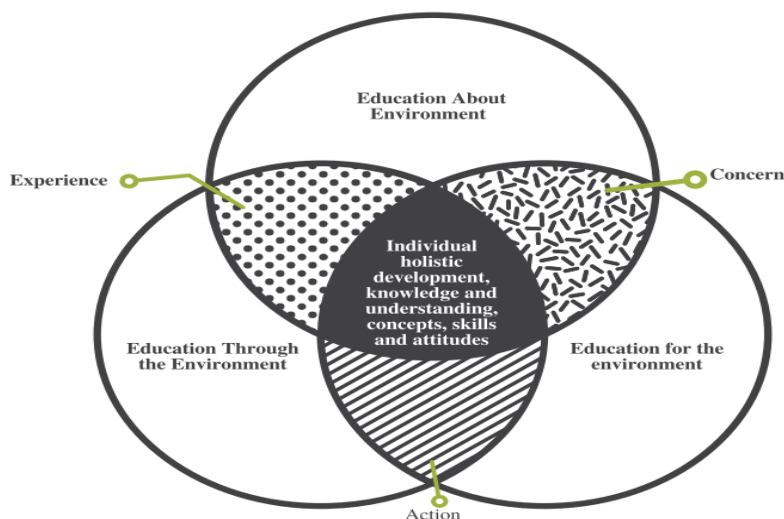


Figure 20 Holistic Approach in teaching EE (Source: Palmer, 2002)

6.3 What are the factors that enable the teaching of EE?

On what factors enable the teaching of EE, two subthemes on factors that facilitate teaching EE emerged upon analysis of data from the questionnaire and focus group interviews, specifically: adequate teacher pedagogical knowledge and positive teacher attitude. These two subthemes are presented next.

6.3.1 Adequate teacher PCK

PSGTs were of the view that teachers of EE ought to have both content knowledge and pedagogical knowledge in order to be able to teach EE. The following excerpts testify to these claims:-

Learning about ESD and EE is good, I know I can teach it in school, I will be able to interpret the curriculum, its requirements, use local resources to teach learners about environmental issues they encounter, matching teaching to your learners' abilities. (Q, P10)

Field tours, seminars will make students more aware about the environment if the university lecturers use these methods rather than theoretical lessons in class (Q, P12)

Teaching of modules such as ecosystems, urban geography and industrial geography empowers students to learn more about the environment (Q, P14)

Excerpts from the focus group interviews validate the above claims.

Some sections are difficult to teach, teachers must know what (content knowledge) to teach and how (pedagogical knowledge) to teach, they must be lifelong learners as environmental problem change all the time (FGI, 3- P3)

I feel confident to teach EE, ESD or about SD as I know my content and know which teaching strategies to use to teach the different sections, I have a positive view towards the environment and like to address environment issues, I can influence learner to do the same (FGI-2P3)

Participants in this study were of the view that the knowledge they had acquired in their teacher training (*Learning about ESD and EE is good*) had equipped them to teach EE (*I can teach it in school*). PSGTs recognised that teaching EE entails more than having content knowledge, it entails *interpreting the curriculum, its requirements, use of local resources to teach learners and matching teaching to your learners' abilities*. In other words, teaching is seen as a complex process, that is facilitated by cohesion between the many interconnected aspects. Furthermore PSGTs were aware of the need for active teaching methods to be modelled for them by teacher educators at university (*Field tours, seminars will make students more aware about the environment*). In this regard, Summers and Childs (2000) affirm that while scientific knowledge is important, it represents only one aspect of the complex knowledge base required to teach environmental issues, with pedagogical knowledge also playing a pivotal role in good EE.

In these excerpts, the links becomes visible between having deep content knowledge (CK/SMK) (*I know my content*), PSGTs confidence in their ability to teach (*confident to teach EE, ESD or about SD*), having teaching strategies (*know which teaching strategies to use to teach the different sections*) and pro-environmental behaviour among PSGTs (*I can influence learners to do the same*). The data from the above excerpts confirms that deep pedagogical content knowledge is the platform for creating awareness of and instigating strategies needed to address environmental issues while initiating pro-environmental behaviour among PSGTs. In other words, the link between pedagogical content knowledge, pro-environmental behaviour and the quality of teaching performance becomes explicit. Put differently, this means that cognitive abilities (CK) and affective-motivational characteristics as the two key components behind PSGTs' professional competence. The cognitive aspect of content knowledge becomes the foundation of PSGTs' abilities to understand, critique and participate rationally in the value laden issues around sustainability (*teachers must know what to teach and how to teach*). Ismail (2017) expresses a similar view, that the teachers' pedagogical understanding of EE is the foundation of their teaching in this area. If a teacher is not confident in teaching a particular topic in EE she or he will overlook it or ignore it. Yenken

et al. (2000), furthermore, emphasises that developing environmental literacy (EL) among students is dependent on the teachers' environmental cognition, which entails his or her belief systems and values as well as cognitive knowledge.

Thus, it can be inferred that a lack of EE content knowledge and pedagogical knowledge would negatively impact the teaching of EE. This would inhibit PSGTs from being drivers of EE once they qualify as practicing teachers (National Environmental Education Advisory Council, 2005). Yavetz, Goldman and Pe'er (2014) argue that teachers should have sound knowledge of ecological principles, ecological process and environmental challenges in order to promote learning of EE among their students. Furthermore, UNESCO (2015; 2017), Esa (2010), Sungur, Ertepinar and Kaplowitz (2009), as well as McKeown and Hopkins (2002) assert that knowledgeable teachers are key agents for promoting meaningful EE.

EE is central to achieving the goals of a sustainable society and an environmental literate citizenry (UNESCO, 2015). It follows, therefore, that in schools, the key to successful EE is the classroom teacher. Teachers are therefore vital for quality education as they enact and interpret the curriculum through their use of pedagogy with learners (Cutter & Smith, 2001; Dada, Eames & Calder, 2017). Pre-service teachers do need education in both the subject matter (CK) and pedagogies (PK) appropriate to EE in order to achieve the competencies of an environmentally educator (Alvarez-Garcia, Sureda-Negre & Comas-Forgas, 2015) so that they can play a key role in developing environmental literacy in future generations (Tuncer, Boone, Tuzun & Oztekin, 2014). Therefore, subject matter knowledge of ecological principles, processes and human impact on the environment forms the basis of subject matter or CK. Thomas (2009) suggests that practical fieldwork is the signature pedagogy in outdoor education, with its key feature of providing learner-centred experiential learning. Nelson (2010) argues that for EE knowledge development to occur, teacher education programmes should engage in pedagogical or instructional approaches that use inquiry, view teachers as learners and have teachers who use, engage and reflect on appropriate pedagogical content knowledge. In summary PCK is defined by Fernandez (2014) as the transformation of content into powerful learning experiences, based on teachers' understanding of learners and their needs in context.

6.3.2 Positive teacher attitude

As alluded to in the previous section, PSGTs' deep pedagogical content knowledge increases their confidence in teaching EE because they know 'how and what to teach'. This confidence influences PSGTs' attitudes towards teaching EE positively. The excerpts below illustrate this:

There would be no challenges because in our day-to-day life we experience some environmental challenges at home so learning about it, like deforestation and erosion helps me to know how to address the challenges. I'm sure I can teach this at school and also get learners to develop the right positive attitude and care for the environment (FGI-P-A5)

I won't experience problems teaching EE, because I appreciate and value of the environment. This is due to studying about EE therefore I care deeply about how our actions effects the Earth (FGI-P-B3)

Similar views were expressed by PSGTs in the questionnaires:

If you have a positive attitude towards a task you can do it, it's the same with teaching, if you like teaching, you enjoy it, it will be easy, then only will you have a positive attitude to it and will be passionate about the topic (Q, P19)

The above excerpts illuminate the intrinsically intertwined connection between teacher attitude to teaching (*no challenges, won't experience problems teaching*) and teaching ability (*you enjoy it, it will be easy*). They reveal that PSGTs embrace the idea that from having learnt about EE they have the knowledge needed (*learning about it, like deforestation and erosion*) to address environmental issues (*helps me to know how to address the challenges*) and consequently develop positive predispositions to teaching EE (*you enjoy it, it will be easy, then only will you have a positive attitude to it and will be passionate about the topic*). Put simply, it means for PSGTs that because they have learnt about EE, they possess the cognitive (knowledge), affective (emotional, motivational) and performance (behaviour or action tendencies) components needed to teach EE. In this regard, Frazen and Vogl. (2013) argues that positive environmental attitudes and values among teachers are important in teaching ESD and further argues that negative social attitudes, values and lifestyles are often obstacles to improving environmental quality. Similarly, many scholars are of the view that the implementation of EE depends initially on the attitudes or receptivity of teachers (Cheng & Monroe, 2010; Skanavis, Petreniti & Giannopoulou, 2004; Taylor, Doff, Jenkins & Kennelly, 2007; Cutter-Mackenzie & Smith, 2003). A study by Kaplowitz and Levine (2005) confirms the significance of individuals having appropriate environmental attitudes for positive contributions to environmental knowledge. These scholars assert that positive attitudes towards EE and caring for the environment are a panacea for improving environmental education efforts.

A study by Nguyen (2001) reported that the quality of EE in primary schools depends on the teachers' awareness and attitudes. Teachers who had awareness or knowledge of environmental processes and issues displayed a willingness to teach about these environmental issues and involve learners in activities to address these environmental challenges. The converse was also evident (Nyugen, 2001). Many studies, such as those by Lim (2005), Sharifah, Laily and Nurizan (2005), Aini, Falhrul, Lily and Jariah (2003), Tuncer, Sungur, Tekkaya and Ertepinar (2007), Antonakaki, Kontaxaki and Bouras (2007) and Pe'er, Goldman and Yavetz (2007), confirm that when teachers' understanding of environmental issues was shallow, they did not display pro-environmental behaviour, instead, it resulted in their students having a superficial understanding of these issues. Ismail (2017) argues that if teachers lack sufficient knowledge, desire to implement EE in schools, it is improbable that environmentally literate students will graduate from the school system. In order for students to have sound knowledge and develop good values towards the environment, teachers' knowledge base is of great importance, because good knowledge (SCK and PCK) is essential for effective teaching (Summers, 1994). Thus, it is imperative for PSGTs to be equipped with good environmental knowledge, attitudes and behaviour.

6.4 What are the factors that constrain the teaching of EE?

At the opposite extreme to the ideas in the previous section, two subthemes about factors inhibiting teaching EE emerged upon analysis of data from the questionnaire and focus group interviews; these were Inadequate training in terms of teacher pedagogical knowledge and Lack of resources. Discussion of these subthemes follows.

6.4.1 Inadequate training in terms of pedagogical content knowledge in EE

It is widely believed that besides the importance of subject content knowledge teachers should also have sufficient pedagogical knowledge in EE, as most of the participants testify in the excerpts below.

If you are not familiar with the content for EE, you cannot teach it. Having content alone does not help, we need exposure to different methods we can use to teach it. (FGI 2-P5)

Yes, due to lack of understanding emanating from poor content knowledge there is need for pragmatic learning which enhances understanding of environmental issues. Moreover, EE is linked to other subjects and concepts, therefore becomes difficult to understand since it's not a standalone subject (FGI-3-P1)

Similar sentiments were expressed in the questionnaire:

I did not enjoy teaching EE during practice teaching as I battled with the content and how to teach it (Q, P15)

The above excerpts highlight the tension between poor content knowledge (*If you are not familiar with the content for EE, having content alone does not help, you cannot teach it*) and appropriate teaching strategies (*how to teach it*) needed to teach EE. It also elucidates that special teaching strategies are needed to teach EE (*lack of experiments and field trips*). These views correspond with observations made by Symons (2008) and Lotz-Sisitka (2011), who found that teachers' poor knowledge of sustainability issues, arising from their lack of appropriate training in their teacher education programme, was a significant constraint to their implementing education for sustainable development. A study by Cutter-Mackenzie and Smith (2003) found primary teachers to have poor knowledge about environmental issues, where 85% of participants did not receive any formal training in Education for Sustainability (EFS) at university. Further studies by Taylor, Doff, Jenkins and Kennelly (2007), Tomas and Mills (2011) and Yavert, Goldman and Pe'er (2014) point teachers' implementing EFS in schools depends on their having had formal training in ecological principles during their teacher education programme. In addition, teachers require knowledge of instructional strategies to teach EE. There is a widespread view that teachers' conceptions of pedagogy plays a crucial role in their effectiveness as mediators between the subject and learner (Ismail, 2017). The teachers' PCK will enable learners to extend EE that had been taught in the classroom to contexts outside the classroom, and so learners would also be agents of social change. Ismail (2017), in support of the above view, emphasises that teachers need to know and accept content, evaluate student ideas and understanding and provide learning experiences to align students' conceptions with scientific explanations. In addition to CK and PK, knowledge of context and resources available to the school is important (Ming-Yueh, Jon-Chao & Yung (2018). Experts from the community, environmental management agencies and non-governmental organisations (NGOs) could serve as facilitators in design of EE. Accordingly, this gives weight to the saying: "It takes a community to raise a child, all members of society are needed to nurture a healthy environment". EE calls on all members of society to protect the environment at all levels. At all levels collective action needs strong alliances and commitment to processes that allow us to work together and learn together (Kean, Brown & Dyball, 2005).

6.4.2 Lack of resources

A second theme of constraints for effective teaching and learning in EE is that it is contingent on both human and physical resources, which is evident in the excerpts below.

There is a major challenge in the learning process. It is more theoretical and there is need for practicals to expose pupils to real environmental issues (FGI-P- B5)

Yes, because at times it is difficult to vary teaching methods due to lack of resources, e.g finance for field trips and bringing in environmental experts for guest presentations (FGI-4-P3)

Due to lack of modern approaches like GIS [Geographic Information System] and remote sensing and resources for simulated learning of EE teaching and learning is challenging (FGI-3-P2)

Similar ideas pertaining to lack of resources were expressed in the questionnaire:

It is impossible to teach someone to read a map if there are no maps to read (Q, P13)

Attending seminar workshops or hiring specialists from other departments, might help the challenges encountered with resources as they will bring current information which suit the modern world (Q, P9)

The lack of resources (*lack of modern approaches like GIS and remote sensing and resources for simulated learning of EE*) become barriers to both the teaching (*it is more theoretical, hiring specialists from other departments, might help the challenges encountered with resources*) and learning of geography (*impossible to read a map if there are no maps to read*). From the above excerpts the kinds of resources needed to teach EE in geography come to the fore (*Maps, GIS and remote sensing, and resources for simulated learning*). The need for experiential field based teaching and learning is also illuminated (*field trips*). Fieldwork is perceived to be an essential part of studying geography (Pawson & Teather 2002). The value of fieldwork lies particularly in providing students with a better sense of real world environments and processes that cannot be duplicated in class. From the excerpts above, having field trips is a big challenge (*finance for field trips*), because they are costly. Studies by Hughes & Overton (2009) mention that fieldwork is a robust feature in EE in geography, but Brown et al (2012) note that it can be unpopular due to its high cost and time it takes to plan and execute.

6.5 Novel finding: PCK and positive teacher attitude

The study established a new PCK model as explained in detail in chapter 8.

From the discussion in section 6.3 and 6.4, it is evident that teachers' positive attitude and PCK (or the lack there of) can either enable or constrain the teaching of EE. My finding elucidate that PSGTs pursue the

teaching of EE with confidence when they feel competent and avoid teaching EE when they doubt their capability to perform successfully. My findings reveal that PSGTs' confidence level and emotions about EE are linked to their cognitive ideas about the EE, as related to the curriculum, students' understanding and teaching strategies. This means that PSGTs use their emotions, particularly confidence, to scaffold learning. Thus, it can be reasoned that emotions or confidence are at the heart of teaching and that teaching is highly charged with feelings, aroused by and directed by values and ideals. Hence, teachers are more than just subject matter specialists who are *aufait* with content knowledge and pedagogical knowledge, they carry their disposition with them into the classroom. Their disposition is an innate part of who they are, it impacts their intuitions, their ability to make judgements, how they develop content, interpret curriculum, improvise, respond to situations as they occur whilst teaching and reflect on their teaching.

PSGTs perceptions of their ability or confidence to teach EE mediate their teaching of EE. This is their first level of emotional connection to the EE content knowledge (CK) or subject matter knowledge (SMK). The second level of the emotional connection relates pedagogical knowledge where CK is transformed into action in response to the learner's needs. The third level of emotional connection is to the teaching context, which enables or constrains the teaching of EE. Therefore it can be reasoned that PSGTs' PCK is also sculpted by an affective component; that is their emotions, attitudes, values and beliefs. This particular finding resonates with Bandura's notion of self-efficacy (1986), which indicates that individuals' perceptions of themselves mediate their behaviours and actions.

These findings highlight the limitations of the current model of PCK, which focuses on the content knowledge and pedagogical knowledge, and justifies a call for an extension of the current model to include teachers emotions attitudes/values or beliefs as an affective component.

The data highlights that an affective component is linked to three levels; namely, subject matter (first level), pedagogical knowledge (second level) and context (third level) as reflected in Figure 21 below.

New PCK Model

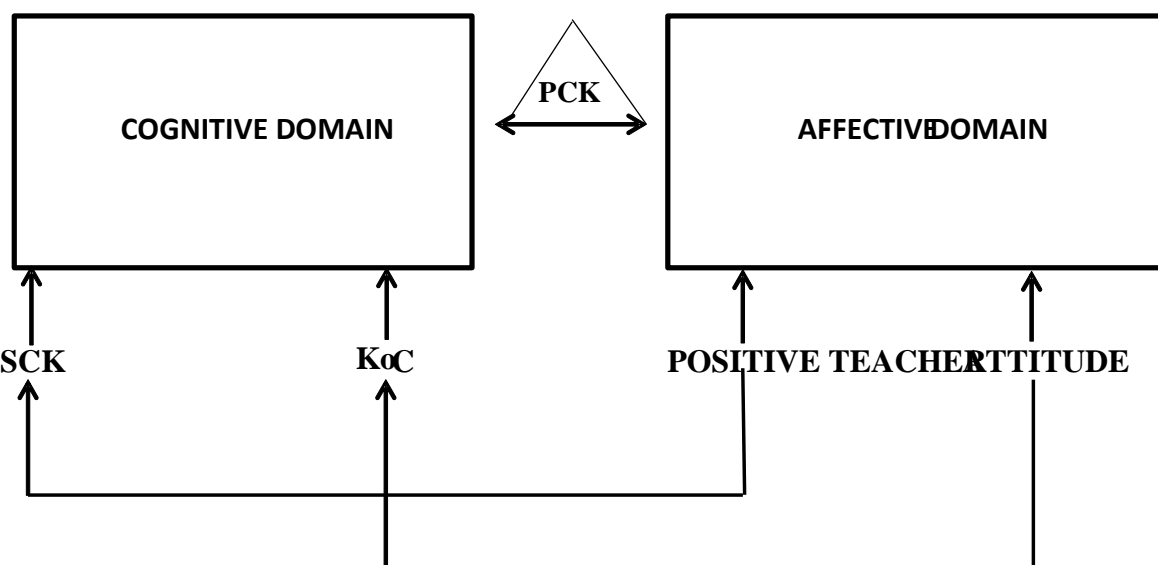


Figure 21 New PCK model incorporating Cognitive and Affective Domain

The PCK model proposed in this study embraces the idea that affective factors influencing teachers' practice are complex and infiltrate all levels of PCK. The research evidence indicates that “teachers’ beliefs/values/emotions colour and influence their teaching practices, how they believe content should be taught, and how they think students learn” (Harwood, Hansen & Lotter, 2006; Philipp & Johns, 2012).

6.6. Summary of Chapter 6

This chapter has presented evidence in answer to Research Question 2. PSGTs considered teaching EE as important; they believe it gives learners knowledge of EE and ESD as well equipping them with skills needed to deal with environmental challenges. Two factors enabled PSGTs ability to teach EE, namely their PCK and a positive attitude. Two factors also constrained the teaching of EE, namely, lack of PCK and lack of resources. The findings of this study illuminate that teachers carry their personal disposition with them into their classrooms. Teachers’ personal disposition impacts their teaching and engagement with learners. The analysis of data reveals that the current PCK model is limited because it does not include an affective component. It is reasoned that the affective component is linked to the subject matter, pedagogical knowledge (with its many sub-components) and the teaching context, as was shown in Figure 21.

The next chapter will consider analysis on how pre-service geography teachers can be enabled to teach EE in effective ways.

CHAPTER 7: ANALYSIS AND DISCUSSION OF DATA FOR RESEARCH QUESTION 3.

7.1 Introduction

This chapter focuses on Research Question 3: *How do pre-service geography teachers learn environmental education?* The research question was addressed using the photo narratives and reflective diaries that had been compiled by each group of pre-service geography teachers (PSGTs). As mentioned previously in Chapter 4, before the study commenced PSGTs were given information on what the study entailed. They were also provided with information on experiential learning theory (ELT) and participatory action research (PAR) and had work shopped how to create photo-narratives and reflective dairies. Therefore, in this chapter I report on how PSGTs learn EE when dealing with the environmental challenges they had identified in Masvingo. The environmental challenge identified for further exploration by each of the four groups is shown in the Table 1 below.

Table 1 Summary of environmental challenges studied by groups A, B, C and D and my role

GROUP	ENVIRONMENTAL CHALLENGE
A	Deforestation in Masvingo periurban area
B	Land Pollution (poor waste disposal) at the vegetable market
C	Water pollution of Mucheke and Shagashe rivers
D	Sewage bursts in Mucheke residential area
My Roles	<ul style="list-style-type: none">• Applying for permission from Masvingo City Council for tour of hotspots and intervention programme• Seeking permission to visit and access information from EMA• Coordinating visits to environmental hotspots with EMA and PSGTs• Overseeing weekend practical interventions of PSGTs in their chosen areas• Sourcing transport from the university's Department of Transport for PSGTs to and from the community area under study

The map below shows the locations of the environmental challenges observed during the guided tour.

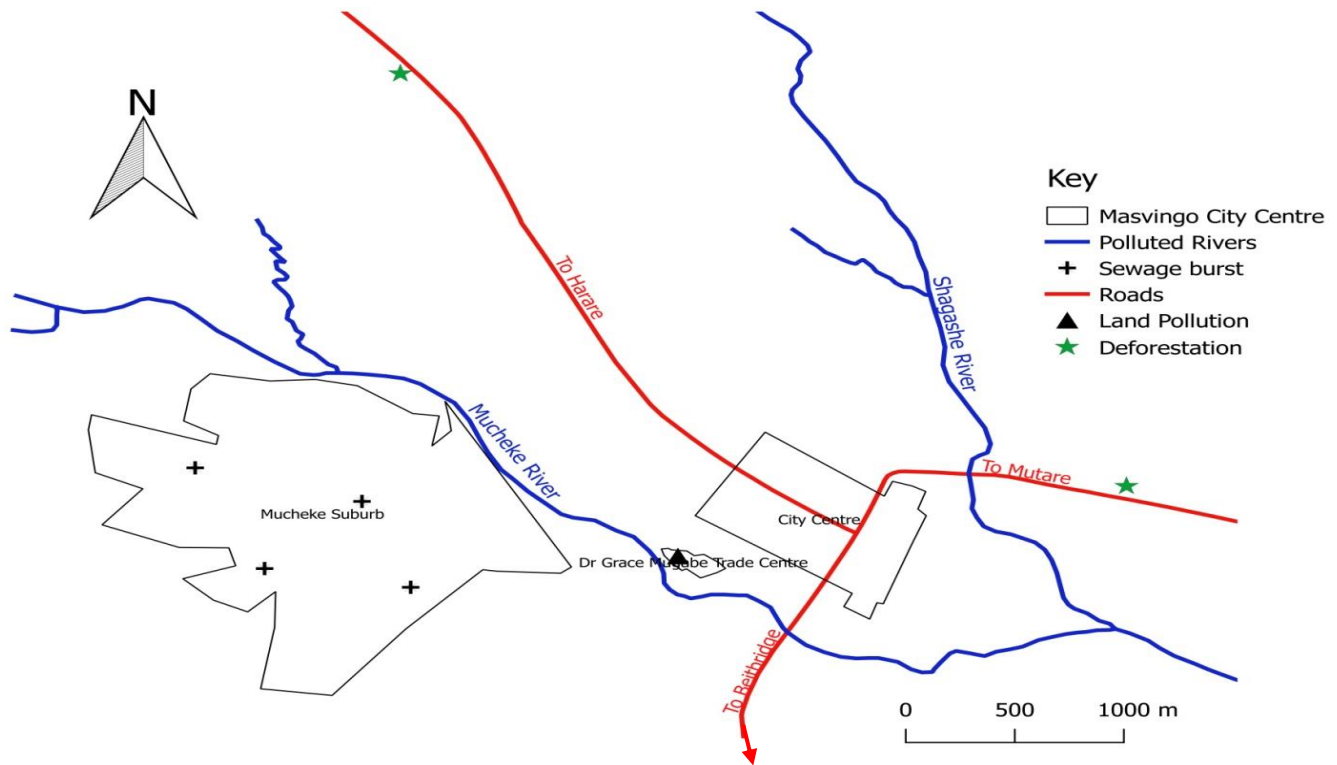


Figure 22 Map showing locations of environmental problems

7.2. Analysis of data

The data generated through photo-narratives and reflective diaries is presented as an individual case for each group. This mean there are four cases of learning, labelled as A, B, C and D, that will be presented here. As described in Chapter 4, the photo narratives were analysed by looking at the photo and ascertaining what important visual image it contained. I used the PSTGs accompanying narratives to look “behind” the image to examine the context that had shaped the image. The reflective dairies were subjected to content analysis.

Guided by constructs of ELT /PAR the data is presented in the following ways:

- Identification/planning of the environmental challenge
- Implementation of the interventions

- Evaluation of interventions in a cyclic way
- Reflections on the intervention implemented
- Second/third cycles of intervention

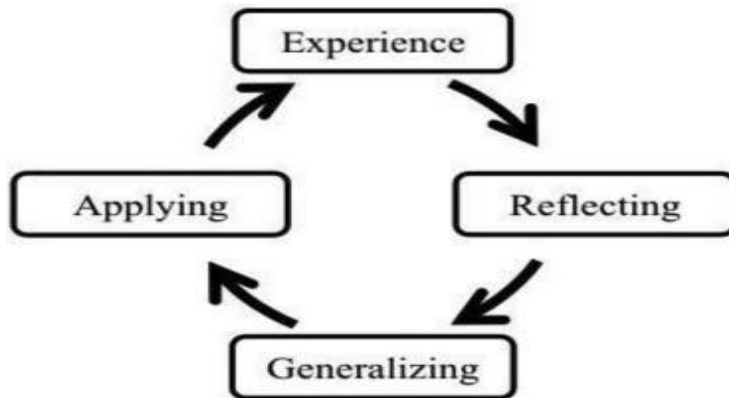


Figure 23 ELT and PAR (Source: Kolb, 1984)

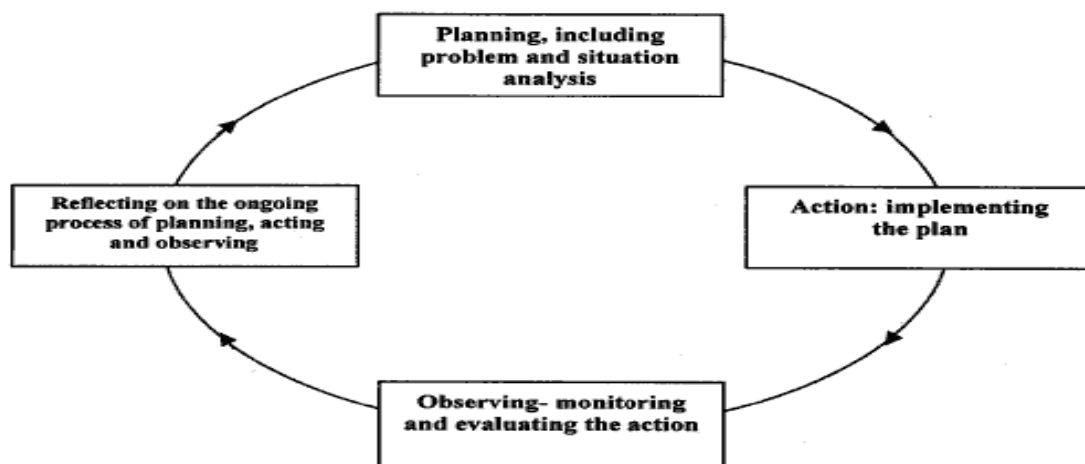


Figure 24 Action research cycle (Source: Hollingsworth, 2001)

The key to read data excerpts is as follows:

Photo-narrative: PN-Ai represents the photo narrative of group A, while the Roman numerals represent the number of the entry, i onwards. The number of photographs was not limited. Each group may have taken more than four photographs.

Reflective Diary: RD-Ai represents group the reflective diary of group A, while the Roman numerals represent the number of the entry, i onwards. Again the number of entries was not limited.

7.3 Group A: Deforestation in Masvingo Peri-Urban Area

7.3.1 Identification of Problem and plan

According to the data, the main cause of deforestation is that residents cut trees for firewood and to sell for income. I present data from the photo-narrative and then relate it to data from the reflective diary. Thereafter I present supporting literature.

Residents cut trees for firewood for use and sale

Photograph Ai: Depicting women carrying firewood from the peri-urban area of Masvingo



People are poor and unemployed, they depend on firewood as a source of energy... it is freely available so people just cut trees every time they need wood, we see women with babies carrying wood. I can imagine how hard these women work-walking long distances to gather wood...I wonder if they think about planting more trees (PN-Ai)

Photograph Aii: Showing stacks of firewood for sale



People eke out a living on selling firewood. This is a means of survival for the boy in the picture. (PN-Aii)

It is visible from the photograph above that firewood is an essential commodity (*source of energy*) in many poor homes in Zimbabwe. The excerpt also alerts us to the context of unemployment which exacerbates poverty (*are poor and unemployed*) and dependency on fire woods as a source of energy (*just cut trees every time they need wood, is freely available*).

The following excerpts from the reflective diary reinforce the responses from the photo-narrative

These are thin, lean women who are carrying bundles of firewood, they have their babies with them-I can imagine all they want is to cook and keep their families warm. They don't seem to worry about cutting down trees or the need to replace cut trees. May be we need to try and create awareness to curb the cutting of trees, these are God fearing women with children. Maybe we can address the cutting of trees at church. (RD-Ai)

People are so poor, this boy belongs in a classroom yet he is selling firewood when school is on, its sad when children have to deal with adult responsibilities so early in life is on. Electricity is unaffordable to most people, it is easier and cheaper to cut trees from the forests, anyone can go to

the forest and cut wood , the important thing is to plant more trees, but how? Who will they listen to? Aah the pastor is a man of great influence. (RD-Aii)

The above excerpts reiterate the plight and hardship that poor citizens have to endure (*thin woman, people are so poor, electricity is unaffordable to most people*) in terms of their energy requirements. Hence deforestation is a means of meeting the energy needs for many people in Zimbabwe (*keep their families warm, wood is free*).

The identification of the above environmental challenges resonates with studies conducted in Zimbabwe by Dube, Musara & Chitamba (2014), Chambwera (2004) and Mandelli, et al. (2014). These studies found that deforestation is a major challenge in Zimbabwe, with 63% of Zimbabwe's population relying on wood as the main source of energy for cooking and heating. The reliance on wood for energy stems from the high unemployment rate (around 95%), limited financial resources, lack of access to other forms of energy such as gas, the cost of purchasing electrical appliances, which also need to be maintained regularly, as well as the exorbitant cost of electricity in Zimbabwe.

The excerpts above elucidate group A's plan to address the issue of deforestation by inculcating pro-environmental habits such as tree planting among people (*replace cut trees, plant more trees*) thereby raising environmental consciousness in order to change current practice (*they don't seem to worry about cutting down*). The church is seen as a key avenue for the launch of their plan (*maybe we can address the cutting of trees at church; these are god-fearing women with children*) and the pastor is a powerful element in their plan (*man of great influence*) who can influence his congregation (*these are God-fearing women*). Put simply, group A's plan was to create environmental consciousness among the community (*at their church service*), by alerting people to consequences of 'firewood harvesting' and the need to conserve trees or plant replacement trees.

To put the plan into action the group approached the church pastor for support as is reflected in the excerpt below:

We turned to Pastor Smith for support, initially we were not confident about approaching him, but 3 members from our group attend his church. He liked our idea, and gave us permission to address churchgoers after the Sunday praise service. We were so excited, we met many times to research the information we were going to give to the community (RD-Aiv)

The pastor supported group A's plan (*him... he liked our idea; gave us permission to address churchgoers*). The group met to prepare (*met many times to research the information*) for their information sharing session with the community.

In terms of learning about EE, it can be seen that group A learnt about deforestation in the identification and planning stage by observation (*we see*), engaging in research/investigation (*to research the information*), consultation with community (*him... he liked our idea*); situational analysis (*worry about cutting down trees or the need to replace cut trees*), sensitivity to context (*unemployed, poor, God fearing*) arriving at conclusions (*they are poor, supposed to be at school*) as well as commitment to effective action (*met many times to research the information we were going to give to the community*).

7.3.2. Implementation of plan 1

Group A informed the community about the consequences of deforesting, as is evident in the following excerpt below:

We told them about global warming, greenhouse effect, soil erosion, loss of biodiversity, water cycle, pollution caused by burning, urban expansion, alternative sources of energy. They listened, they smiled, they nodded as if they agreed with what we said about deforestation, it felt good to involved in empowering the community and making a difference (RD Av)

From the above it can be seen that group A presented a lot of information on the consequences of deforestation (*global warming, greenhouse effect, soil erosion, loss of biodiversity*) to the community. During the implementation of their plan, they experienced a sense of achievement based on the non-verbal responses received from the community (*they listened, they nodded, as if they agreed with what we said about deforestation, it felt good*).

It is evident that during the implementation stage PSGTs learnt about EE by sharing information through interaction (*we told them about, they listened, they smiled, they nodded as if they agreed*) creating awareness (*pollution caused by burning, urban expansion, alternative sources of energy*), empowering people (*it felt good to be making a difference*).

Evaluation of Plan 1

The evaluation of the plan by group A revealed:

We evaluated the impact of our information sharing session with the churchgoers by observing their actions (over four days) to the day for the next church service on Thursday. It seems like the information we provided to them was in vain, they continued to cut trees without re-planting any trees, burnt more firewood in the church yard before the service. It is confusing they seemed to understand, they had smiled and nodded when we spoke to them, I doubt they understood (RD Aii).

From the above excerpt, it is evident that the group evaluated their plan by first *observing their actions* in the community they had addressed. The observation led the PSGTs to question the effectiveness of their plan (*I doubt they understood*). In this stage PSGTs learnt about EE by observing (*burnt more fire wood*), evaluating (*impact of our information sharing session*) and reaching conclusions.

Reflections on Plan 1

The group met to reflect on their first strategy to combat deforestation in Zimbabwe as can be seen in the excerpt below:

Our first plan to empower the community about deforestation failed dismally, we are saddened that our effort was futile, I think we bombarded them with too much of factual information, that was complicated. We forgot we are dealing with informal sector, and provided a summary of our university content. We need to use a simple hands on strategy (RD-Ai).

In the reflection phase PSGTs learn about EE by reviewing their plan (*failed dismally*). They reflect on their emotions (*saddened*) and effort (*was futile*) as part of the learning process. PSGTs acknowledge the flaws of their plan (*bombarded them with too much of factual information, complicated, we are dealing with the informal sector*) and recognise how to remedy this flaw (*use a simple hand on strategy*). The learning that occurred during the reflection phase was based on approaches used, methods of conveying message and their target audience. In this learning process what comes to the fore is that the level of an individual's involvement in pro-environmental actions is affected by their awareness of the environment. Education concerning the environment needs to understand all stakeholders, and awareness of a community's context is needed in order to cascade environmental education.

7.3.3 Intervention Plan 2

For the second intervention, group A decided to collaborate with the Forestry Commission, whereby a partnership was forged to provide mango trees to the residents of Masvingo to plant.

Photograph Aiii. Showing mango trees that were planted in Masvingo peri-urban area.



Mango Trees planted by environmental groups in Masvingo Peri-urban (provided by Forestry Commission) as part of reforestation in urban area of Masvingo (PN-Aiii)

Implementation of Plan 2: Making use of Pastor to influence church members to adopt forest conservation by church members

Group A approached Pastor Smith to discuss their second intervention plan which was to plant trees in the church yard and in and around Masvingo. The group pledged to facilitate the sourcing of mango tree from the Forestry Commission. The excerpt below from the reflective diary confirms the sourcing of trees from the Forestry commission:

We assure you pastor we will do all the planning, transporting and coordination of the tree planting process. Trust us, we are a part of your church for many years. We have already contacted the Forestry Commission for seedlings, they are very supportive. We asked for fruit trees as it will benefit the community, it's a good way to produce food and they won't go hungry. RD-Aiii

The excerpt above reveals the collaboration PSGTs engaged in (*you pastor Forestry Commission*) as well as the pledges they made (*assure you*), the planning they undertook (*planning, transporting and coordination of the tree planting process*) while learning about deforestation and EE. The group sees the planting of mango trees as a way to rehabilitate the environment and to address issues of hunger and food supply. In the learning process they are sensitive to contextual issues (*they won't go hungry*).

Based on the reflections, PSGTs are capable of expressing the concepts deforestation and reforestation while embracing ideas of collaboration, community learning and addressing important community issues (*poverty, hunger*). These collaborations equip PSGTs with the knowledge, skills and approaches in management and environmental sustainability, especially in terms of deforestation and reforestation.

Evaluation of Plan 2

The evaluation of plan 2 reveals:

Even though seedlings were available at the church the community only planted trees if we were around and drove the process. They did not buy into the idea totally. I thought that they would run with the tree planting idea. It is disappointing especially since we are students and are investing our time in the project. Our efforts are not appreciated we need to try something different to get them to change their habits and attitudes this is not a simple straight forward process. (RD-Aiv)

Upon the evaluation of their second plan Group A realised that the community did not take ownership of the idea to stop deforestation and to start reforestation. The plan worked to some extent; but only with their continued support. The disappointment the group encountered when their effort to bring about change was not accepted also comes to the fore. As a way forward group A decided to try a new strategy to change the community's habit in terms of halting deforestation and initiating reforestation.

In terms of learning about EE group A realised it is a trial and error process, that replacing poor environmental practices with pro-environmental behaviour is a long process (*this is not a simple straight forward process*), that requires many different strategies (*we need to try something different*). This means that learning about EE is similar to problem solving as it is characterized by repeated, varied attempts, which are continued until success is achieved.

Reflections on Plan 2

Reflection on plan two reveals that PSGTs:

We need to get the women involved, working with the men was not really successful, they only planted tree in the church yard. It is like they need constant reminders of what needs to be done, they lack agency (RD A ii)

As can be seen from the above excerpt the group decided to include women as part of their strategy; believing that women are more nurturing and receptive to pro-environmental ideas and actions than men.

In terms of learning about EE the group realises the need to re-shape their second idea based on their experience that men only engaged in pro-environmental behaviour under supervision. Group A reflected on the consequences of their action of only including men in their intervention plan for halting deforestation and initiating reforestation. Group A realised the need for collaborations and systems thinking (the need to include role players like women) when solving environmental issues.

7.3. 4 Intervention 3

Plan and implementation: National Tree Planting by all church members with the Forestry Commission, EMA and Council

The group decided to educate church members on the National Tree Planting Day which occurs on the first Saturday of December each year. Efforts were made to educate both men and women on deforestation, reforestation and the values of trees. The Forestry Commission was called upon to assist with information sharing and the provision of seedlings at various sites in Masvingo. Flyers were distributed to educate members of this important day in Zimbabwe's efforts of reforestation for the country.

Photograph Aiv: showing community members from Masvingo receiving mango tress for reforestation.



Distribution of tress by Forestry commission to the local community for National Tree Planting Day. (PN-Aiv)

Photograph Av: Reflecting community members watering seedlings planted on National Tree Planting day in Masvingo



The group joins some members from the community in watering seedlings that were planted on National Tree Planting Day. The Forestry Commission had provided free seedlings to residents. The intervention was successful as over 200 trees were planted. A month later the trees were being cared for by the community. (PN-Av).

Evaluation of National Tree Planting Day

There was a greater buy-in of our third intervention. Women were involved and the Forestry Commission had addressed the church-goers on deforestation, reforestation and the value of trees. Also the Forestry Commission distributed seedlings at various sites in Masvingo. In terms of learning about EE the group learnt about the need to have multiple committed role players to address environmental challenges.

Reflections on Intervention 3

Upon reflection on this intervention the group noted positive aspects, such as National Tree Planting day becoming a annual event in the church's calendar, the support from the pastor, the Masvingo Municipality and Forestry Commission. The group also learnt the importance of involving women in solving environmental challenges. In terms of learning about EE the group learnt that it is an ongoing process. These finding reveal that the capacity for young people to act as catalysts of environmental change in relation to their community is grounded in real world contextual experiences.

7.3.5 Summary of the application of ELT and PAR in experiencing and intervening on deforestation.

Group A experienced the challenge of deforestation in Masvingo peri-urban. They learnt about and analysed the causes of deforestation through photo narratives and reflective diaries as shown above. In the application of ELT and PAR, the group learnt the following about deforestation:-

- Council should involve stakeholders from as early as it is noticed and apply bylaws at the right time.
- From a socio-economic point of view the group gained knowledge on reasons underlying deforestation.
- The group gained interactive skills through attending church gatherings and the impact of religious beliefs.
- The group learnt the need to plan how residents would carry out their activities with minimum damage to the environment.
- Implementation of an intervention takes time and is a trial and error process. To be effective solutions must involve multiple stakeholders.
- Evaluation taught the group to carefully analyse the intended plans, and to be able to foresee their applicability. Therefore, a lot of lessons were learnt on this environmental problem.

Reflections taught the group to consider and reconsider its approaches in the light of what each result was able to achieve, characteristics of each approach, acceptability of members of the group by church members,

acceptability of each idea proposed by group members, the need to interact at the lowest level with members of the church. Members of the group respected the belief systems of the church and tried to live with and by it during interactions.

Figures 25 and 26, below show Kolb's learning cycle and PAR cycle is applicable to group A study and reflection on deforestation.

Figure 25 below represents Kolb's learning cycle for group A.

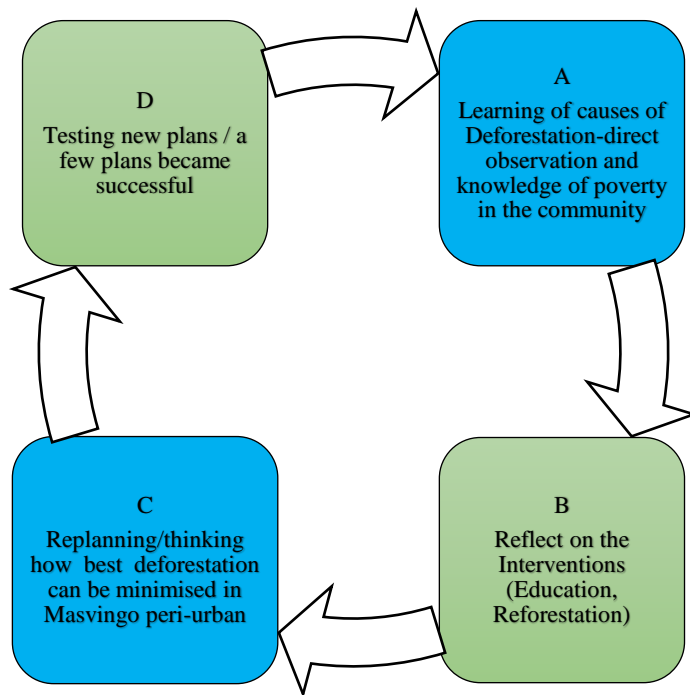


Figure 25 Kolb's Learning Cycle for group A

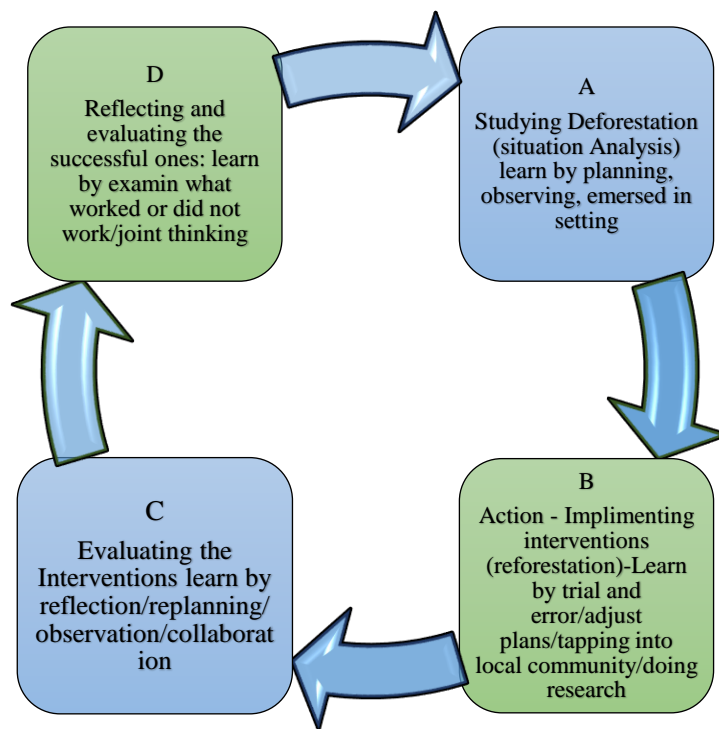


Figure 26 Participatory Action Research Cycle for group A

7.3.6 Summary for group A

The group learnt a lot, as shown in the details above, on the causes of deforestation which is an emerging peri-urban problem. PSGTs raised questions, proposed explanations, used observations, planned and carried out activities as well as critiquing their plans for interventions. The interventions implemented yielded knowledge to the group and the Council as well. Planning of activities in council areas is necessary to avoid future problems as evidenced by the study of deforestation.

The group A PSGTs learn the principles of EE in several important ways. Firstly, by observing what was happening in the environment. These observations of their environment raised their own consciousness by interacting with communities and people in charge of communities. Observations then allowed for identification of challenges and planning ways of addressing them. PSGTs visited a site where there were environmental challenges, immersed themselves in these situations, engaged with the community by talking to them, taking pictures of the challenges, trying to interpret what they saw and experienced by reflecting . Thereafter, they implemented their plan by taking interventionist action. They captured evidence of their experiences in a reflective diary and photo-narrative and tried to interpret these. Through collective

reflection and experience they gained certain insight into numerous challenges; for example of poverty among people, suffering, unemployment, no access to affordable energy sources, and people's reliance on natural resources to eke out a living. They gained insight into such possible interventions as the church being a suitable forum to provide EE, the pastor being a resource to convince people to adopt practices which reflect a deepened consciousness of the environment. They examined their intervention and learned that too much theoretical information had been disseminated and the practical needs of the people were not adequately understood by them as researchers. In summary, PSTGs were involved in the following:

Learning by increasing consciousness of environmental challenges

Learning by immersing themselves in communities and observing environmental challenges

Learning by planning an intervention strategy

Learning by tapping into possible resources (church as education site; pastor as human resource)

Learning by intervening – I immersing themselves in experience of offering people theoretical knowledge

Learning through reflection – analysing effects of intervention

Learning by re-planning

Learning by working collaboratively with established organisations, e.g. the Forestry Commission, and local people in whom community had confidence, such as the pastor

Learning to understand the needs of community and respond to these needs e.g. providing mango trees to plant – addressing reforestation and the issue of hunger

Learning that impoverished people require resources e.g. Seeds/seedlings/plants/transportation

The value of combining intellectual resources (theoretical knowledge on EE), with material resources (trees) and trusted human resources (Forestry officials, municipality and pastor) using a trusted learning site (church), and eager participants (women) enabled success. In addition PS GTs had certain knowledge gains. They learnt that knowledge of a community is important because EE requires understanding a community's needs, culture, etc. They now had knowledge that EE is an ongoing process – there are no quick fix solutions. The next section will look at poor waste disposal as an environmental challenge.

7.4 Group B: Poor solid waste disposal

7.4.1. Identification of problem and plan

The causes of poor solid waste disposal, as identified by group B, included:

- Poor design of bins
- Council failing to collect garbage regularly once a week
- Large number of vendors
- Dumping of mainly perishables such as vegetables, oranges and tomatoes
- Overpopulation of the market against a low demand of market produce
- Close proximity of the market to dust roads
- Vending of all kinds of products such as bottled water, bottled drinks, bottled cans
- Poor toilet facilities at the market
- Lack of running water in the market
- Lack of recycling facilities at the market

I present data from the photo-narrative and then relate it to data from the reflective diaries. Thereafter, I present supporting literature.

Photograph Bi. Depicting an overflowing bin at the market in Masvingo



The three-walled structure, is considered to serve as a bin in the Chitima vegetable market – Masvingo city. Vendors try to confine the waste they dispose within the three walls. The waste thrown comprises banana stems, sugar can stems and leaves, tomatoes, cabbages, plastic materials and old bags. All these waste products come from the market. (PN-i).

Photograph Bii. Revealing dirt outside the bin provided.



Waste that has been accumulating outside the bin for some time. This means that the waste is not collected on a regular basis. Weeds can be seen to have grown tall and dried outside the structure. Metal structures have been dumped outside the bin as well. Apart from being a market for vegetables vendors also sell live chickens. It is unsightly, unpleasant, stinks. This waste poses serious health and environmental problems, people can get ill. The authorities responsible for waste collection are neglecting their duties. They do not conform to the bylaws or check up on vendors, I wonder if they ever bother to encourage recycling. (PN-Bii)

From the photo-narratives above it is obvious that the excessive accumulation of solid waste stems primarily from the waste not being collected regularly (*The authorities responsible for waste collection are neglecting their duties, accumulating outside the bin for some time, waste generated is not collected*). The accumulated waste poses a huge problem at the market (*unsightly, unpleasant, stink*) and it is a health hazard (*serious health and environmental problems*). Furthermore, the lack of attention to, or neglect of, the market area comes to the fore (*Weeds can be seen to have grown tall and dried outside the structure*). The accumulation of waste, the poor design structure of the bin (three-sided wall) and the tall weeds are symptoms of the ailing infrastructure in the Masvingo municipality.

The following excerpts from the reflective diary reinforce the responses from the photo-narratives

This accumulated waste is due to poor service delivery by the municipality. The waste is not collected regularly (RD-Bi)

The lack of proper bins and the number of bins available for such a large market is worrying. What are the vendors supposed to do with their garbage, where and how must they dispose of it? What's irritating is that no one seem to care. There are maggots, flies or cockroaches, the stench is unbearable, and the diseases that can be spread. It is sad the poor are always disadvantaged and they are forced to cope and survive (RD-Biii)

The above excerpts reveal that in Masvingo there are limited resources (both human and infrastructure) for waste collection (*poor service delivery by the municipality*) and inadequate storage facilities or bins (*three sided walled structured, is considered to serve as a bin*). This means that the Masvingo municipality is not meeting their refuse collection obligation. The above excerpts imply the multiple challenges encountered by vendors and people who go to the market, such as exposure to unpleasant decaying matter (*the stench is unbearable*) and organisms (*maggots, flies or cockroaches*) that can spread diseases. It can be seen that the Masvingo Municipality is not adequately meeting their refuse collection obligations, possibly due to financial constraints. The above finding concurs with that of Nyarai, Willard, Moses and Ngenzile (2016), who assert that in Zimbabwe's cities and towns, solid waste management has reached crisis levels as there is a mismatch between planning and policy implementations and this is worsened by financial problems and the lack of human and physical resources.

In terms of learning about EE, it can be seen that group B learnt about poor disposal of solid waste by observation (*waste is not collected regularly*) by their sense of smell (*stench is unbearable*); situational analysis then led them to make deductions (*the number of bins available for such a large market, poor service delivery*) and arrive at conclusions (*maggots, flies or cockroaches, the stench is unbearable, and the diseases that can be spread*). They also critiqued the poor service delivery and the design of the bin structure. The affective domain associated with learning EE is also evident. The members of group B were sensitised to the challenge in the environment and the daily struggles that the market community has to deal with (*what's irritating is that no one seem to care; it is sad the poor are always disadvantaged and they are forced to cope and survive*).

Overwhelmed by the extensive volume of solid waste matter, the presence of maggots, flies and cockroaches as well as the overpowering stench of the decaying organic matter, group B planned to burn the waste outside the 'bin' as is evident in the excerpt from the reflective diary:

If we burn the garbage we will get rid of the stench, the flies and the waste, (RD-Bii).

It is evident that Group B sees burning as a viable solution to disposal of waste as outlined in the plan below.

7.4.2 Implementation of Plan 1

The plan involved burning of waste outside the three walled built structure, commonly referred to as the bin. Rakes were used to form heaps of waste which were then burnt. The waste was an assemblage of organic matter, paper, plastic, cans etc. When set on fire not all the waste burnt. This was probably due to the large volume or the mixture of different waste items, or possibly both. The place was still untidy but the number of flies and cockroaches had decreased.

Photograph Biii. Showing waste gathered outside the bin. The white patches represent some vendors taken during photographing. Vendors' identify remained anonymous as part of ethical considerations



The waste was gathered into a heap for burning outside the waste bin in Masvingo – Dr Grace Mugabe Trade Centre. Vendors heap waste outside the bin. This acts as a source of diseases in the environment (PN-Bii)

Photograph Biv. Depicting waste being burnt.



Burning litter outside the waste bin at Dr Grace Mugabe Trade Centre in Masvingo. The waste consisting of plastic bottles, plant matter, metal objects. There were maggots, flies and cockroaches among the waste. These organisms are a health hazard and will be burnt. (PN-Biv)

In this phase group B learnt about EE by engaging in hands on activity (action), that is gathering waste and burning it. Engaging in action made them realise not all waste materials could be burnt.

Evaluation of Plan 1

The group met and discussed their action of burning waste. The excerpt below sheds more light on their evaluation of their action:

This burning didn't work, there is too much litter, maybe we need to think about separating the waste (RD-Bv).

They could see us trying to burn the rubbish but they didn't seem to care they just threw more rubbish were we had started burning – I tried to explain about diseases, flies, cockroaches. They won't listen, they just dump and move, its like this is acceptable and we are intruding (RDB ii).

The group agreed the plan was not successful (*burning didn't work*) because of a number of factors, such as the large volume of waste (*too much litter*), the waste was an assortment of plastics, twigs, grasses, weeds, shrubs, cans and metal (*think about separating the waste*). The despondency that the group encountered (*they didn't seem to care*) as a result of actions by vendors who continued to dump litter while the group was trying to clean up (*they just threw more rubbish were we had started burning*) and the vendors

not listening to the group's reasoning (*tried to explain about diseases, flies, cockroaches they won't listen*) becomes obvious. Learning of EE occurs by revisiting and evaluating one's action.

Reflection on Plan 1

Group B met to reflect on their first effort to reduce the amount of accumulated solid waste around the market. The following excerpt below gives insight into their reflection:

We didn't consider the vendors at all in our plan, we just took over their space and did what we thought was fit. We didn't think about the consequences of burning nor did we think about the materials we were trying to burn (RD-Biv)

On reflection, a number of lessons were learnt on the intervention. Firstly, the plan did not involve vendors (*The group didn't consider the vendors*) who possibly felt the group's presence was an intrusion into their business (*just took over their space and did what we thought was fit*), cleaning was done during business hours, thereby causing a lot of air pollution to vendors (*didn't think about the consequences of burning*), which could lead to respiratory problems if carried out all the time. The group did not take into account the heterogeneous assemblage of waste and had assumed that it all could burn easily. The plan needed to be refined. Therefore, the group developed the next plan.

Learning involved gaining a deeper insight, including the need to respect all stakeholders as well as respect for the spaces they occupy. The need for negotiations with relevant stakeholders before embarking in any type of community action is an important learning experience for group B. They also learnt more about the need to sort or separate waste material before burning and the consequences of burning waste materials on the environment and humans.

7.4.3 Intervention Plan 2

There was tension within the group about how to proceed with the second intervention. The second plan involved burning inside the "bin" (three walled structure). Permission had been obtained from the Masvingo Council to burn.

We were split in our decision on how to go about with the second plan. I wanted us to sort the waste before burning but I was outvoted. The majority decision was to burn the waste within the bin (RD-Bii).

Learning entailed being conscious about group dynamics and team work when engaging in EE action.

Implementation of plan 2

The second plan involved using old motor oil to fuel the burning of the waste. Burning started well but later on a lot of waste remained unburnt, the plan was not very successful. There was a mixture of vegetables matter, leaves of all kinds, decaying fruit such as avocado pears, tomatoes, oranges, sugar cane as well as chicken droppings. Despite the use of old oil, waste did not burn completely as is visible in PN-Bv below.

Photograph Bv. showing not all waste that was gathered burnt.



PNB v, Burning in progress as a second intervention. The method worked partially – the old oil help to fuel the fire for a bit , the plant matter that was still green did not burn. Lots of black smoke was produced. (PN-Bv)

Photograph Bvi. showing the burning did not get rid of all the waste



Burning in process. The action was not very successful, plastic paper and dry material was burnt and quantity of waste was reduced in the bin. The act killed organisms like flies and reduced bad smell which comes from rotting plant matter. This reduced land pollution which is being caused by wind carrying papers but contributed to air pollution. (PN-Bvi)

The excerpt from the reflective diary confirms the description in the photo-narrative.

Using oil did not work, it only helped to ignite the fire at first, you cannot burn plant matter that contains lots of moisture, the group ignored what we reflected on during plan one and tried to short change the process of dealing with the improper disposal of solid waste matter, this is a process it take time” (RD-Biii).

Learning: sometimes the group tended to forget to incorporate our reflections in our actions

Evaluation of and Reflections on plan 2

The group evaluated their second attempt to reduce waste in the market area. The excerpts below reveal the decisions arrived at during evaluation and reflection.

Burning is not working, we should have considered Max’s suggestion that we separate the waste before burning. We have wasted a lot of time and have not come up with a concrete solution. Burning is causing lots of pollution (RD-Bi)

Those bins, hey something has to be done about them – they are not proper bins, we need to talk to the Masvingo municipality about the bins and the need to educate vendors about waste disposal. How can they know if they are not taught how to compost? (RDB iv).

The group realised that their first and second interventions were both bad ideas (*Burning is not working*) and was not feasible (*have wasted a lot of time and have not come up with a concrete solution*). Furthermore, the group realised the harm caused by burning (*causing lots of pollution*). The group realised they could not address the problem of poor solid waste disposal on their own, that they needed assistance from other stakeholder (*talk to the Masvingo municipality*) to address the issue of solid waste disposal. They diagnosed the problem to be the need for proper bins (*Those bins, hey something has to be done about them*) and the need to capacitate vendors about how to dispose of waste (*how can they know if they are not taught how to compost*).

The group realised that burning was not effective due to the structure of the bin. Council could build or provide a better structure that can contain all waste thrown into it by vendors, something like a full four walled structure to effectively trap waste, council could also encourage vendors to sort out waste and allow them to throw waste accordingly—vegetables bin, fruits bin, plant bin correctly

labelled. Prior to use of this structure vendors need to be educated on the need for good hygiene at the market. Studies elsewhere have observed sorting to be effective, it must developed into a habit by vendors. Therefore, council should come up with such ideas to make collection and storage of waste easy. Involve vendors, they should own the waste and run the business . Council should build a good four walled structure and educate vendors so that they own waste at the market (RD-Bv).

7.4.4. Implementation Plan 3

Plan 3 was two fold, to get the Masvingo municipality to honour their obligations to the community in terms of providing a better structure to contain waste and to get the vendors and market patrons to learn more about waste disposal. The plan was to convince Masvingo City Council to build a better structure that could accommodate waste effectively without it spilling over. Above that council should continuously educate residents especially vendors who run business at the market and ensure vendors take responsibility of waste generation and waste management properly.

We approached the Masvingo municipality and met with the director responsible for waste management. We took our picture of the “bin” (three walled structures) and highlighted why these “bin” are ineffective in containing waste . We also pointed out the high volume of waste produced as more that 200 people visit the market daily and that having one bin will not work. We suggested that if the municipality lacks infrastructure and man power then they must contract members from the community to assist with collection of waste (RD-Bv).

We informed the municipality the community needs to learn about composting and its benefits (RD-Bii).

Evaluation and reflection of plan 3

Plan 3 seemed to be effective. The photo-narrative bears testimony to the provision of more receptacles for waste disposal (*Metals bins were provided for disposal of waste*) and that women were more involved with taking care of the environment (*women are collecting plastics and cardboard boxes from the disposed waste; only women must care about the environment*). Group B reflected on the role of men and women when it comes to pro-environmental behaviour, the group seemed to question and accepted how women are positioned as caretaker and caregivers, within the environmental education setting.

Photograph Bvii. Showing women separating waste.



Metals bins were provided for disposal of waste, women are collecting plastics and cardboard boxes from the disposed waste. It seems like they have taken up the idea of recycling. It's like only women must care about the environment and its cleanliness Where are the male vendors. Are women being casted as care takers and care givers. (PN-Bvi)i

Figure viii: Photograph of clean bin



“Empty bin” after city council refuse collection at Dr Grace Mugabe Trade Centre. The bin looked neat free of any waste and poses no threat to human health as it is no longer the breeding ground for vectors of diseases. (PNB viii)

7.4.5 Summary of the application of ELT and PAR in experiencing and intervening on disposal of solid waste: Group B

Group B experienced the challenge of poor disposal of solid waste at the Masvingo market. They learnt and analysed the causes of poor waste disposal through photo narratives and reflective diaries, as shown above. In the application of ELT and PAR the group learnt the following about poor disposal of waste:

- They learnt by experience of vendors' apathy towards waste disposal
- Engaging in research allowed them to realise the bins provided by Masvingo Municipality are poorly designed.
- They learnt by observation of the inferior ablution facilities in the market area.
- They learnt by trial and error that all waste material cannot be burnt together, that they require sorting and different treatments, e.g. composting.
- They learnt by practice that burning gets rid of flies and maggots.
- They learnt by observation of the need for regular collection of waste from bins.
- Experiential ways of involvement should be practised to truly engage the community in environmental issues.

Figures 27 and 28, below show Kolb's learning cycle and PAR cycle is applicable to group B study and reflection on waste disposal

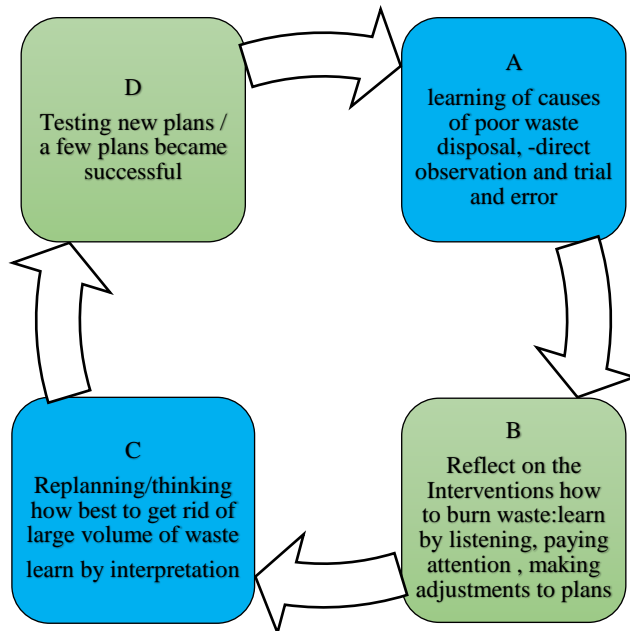


Figure 27 Application of ELT in tackling of poor solid waste in Masvingo by group B

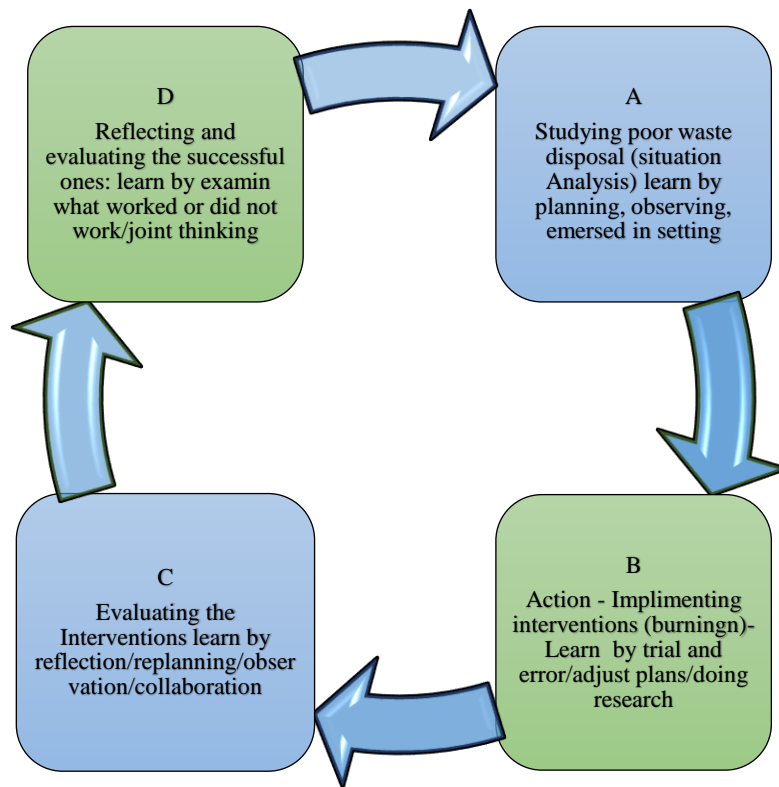


Figure 28 Participatory Action Research for group B

7.4.6. Summary for group B

In terms of EE, group B learnt about poor disposal of solid waste by observation (*waste is not collected regularly*) by their sense of smell (*stench is unbearable*). Situational analysis then lead them to make deductions (*the number of bins available for such a large market, poor service delivery*) and arrive at conclusions (*maggots, flies or cockroaches, the stench is unbearable, and the diseases that can be spread*). They also critiqued the poor service delivery and the design of the bin structure. The affective domain associated with learning EE is also evident. The members of group B are sensitised to the challenge in the environment and the daily struggles that the market community has to deal with (*what's irritating is that no one seem to care it sad the poor are always disadvantaged and they are forced to cope and survive*)

In summary, in this phase group B leant about EE by engaging in hands on activity (action), that is gathering waste and burning it. Engaging in action made they realise that not all waste materials can be burnt. They also engaged in research when they realised that burning maggots limits the number of flies. Learning of EE also occurs by revisiting or evaluating ones actions. Learning involved gaining a deeper insight about

the need for respecting all stakeholders as well as respect for the spaces they occupy; the need for negotiations with relevant stakeholders before embarking in any type of community action is an important learning experience for group B. When learning, sometime we tend to forget to incorporate our own reflections into our actions

7.5. Group C: Water pollution of Mucheke and Shagashe Rivers.

7.5.1 Identification of Problem and Plan

The main causes of water pollution in the Mucheke and Shagashe rivers as identified by group C were:

- Effluent from industrial sites which lie along the Mucheke river: industries discharge oil, and burning tyres along the river bank which will results in waste being discharged in the river
- Disposal of plastics waste in the river beds. This does not decompose rapidly, if at all. Used containers are thrown into the Mucheke river by people from the open market and passersby.
- Sewage effluent from suburbs of Mucheke and from the main town is discharged into rivers, hence polluting the water.
- Used containers from industries thrown into the Mucheke river still contain waste.
- Urban farming along the rivers.

I present data from the PSGTs photo-narratives and then relate it to data from their reflective diaries. Thereafter I present supporting literature.

Photograph Ci: Showing algal growth in the Mucheke River



The picture depicts the growth of algae in Mucheke River – Masvingo. Water pollution is evident by the growth of algae, the green colour of the water indicates the availability of nitrates in the water body, the growth of reeds at banks of the river shows a how fertile the soil is environment. Nitrates come from industrial effluent, agricultural activities and other materials thrown upstream by residents. (PN-Ci)

Photograph Cii: showing litter along the Shagashe riverbed



Higher upstream people dump domestic waste into the river. Plastic products are visible on the banks. These wastes will be carried down stream.(PNCii)

The above photo-narratives reveal that the Mucheke and Shagashe rivers are heavily polluted and pose a threat to both aquatic and human life. The excessive algal bloom (*the growth of algae*) clouds the water (*the green colour of the water*). The disposal of domestic waste and plastics affect the quality of water. The

identification of water pollution as an environmental challenge by the PSGTs resonates with studies conducted in Zimbabwe by Chikodzi, Mabhegedhe and Tunha (2017); Mapira, 2011; Gratwicle, Marshall and Nhwatiwa (2003) and Regina (2012) who found that fresh water ecosystems continues to be threatened by activities such as agriculture, industrialization and urban development. Studies by Gichuki (2014); Varol, Gokot, Bekleyen and Sen (2012) in Kenya reported that approximately 2 million tons of waste per day is deposited into rivers. These include industrial waste and chemicals, human waste and agricultural waste. Gichuki (2014) emphasises that in some cities in Africa, the demand for social amenities has outstripped the ability of city authorities to provide them, as a result of urbanisation. The excerpt from the reflective diary is supportive of the photo-narratives above.

Mothers are washing clothes in the dirty water while children play in the same dirty water. They seem unaffected by the dirty polluted water or the man who is urinating in the water. They wash their clothes even though the water is so dirty. They are unaware of water borne diseases, the children seem to be having fun they are filling their mouths with the dirty water and squirting it onto each other. Maybe this is the only fun they have (RD-Ciii).

Activities such as *washing clothes, urinating in the water* also contribute to water pollution. These excerpts reveal the hardships that many Zimbabweans endure as well as the hygiene challenges they face (*they wash their clothes even though the water is so dirty, filling their mouths with the dirty water and squirting it onto each other*). The above scenario reminds one of the study by Manzungu and Chioreso (2012), which reported that water samples from Zimbabwean rivers failed to meet World Health Organisation (WHO) standards of safe drinking water. These scholars further asserted that the incidence of water-borne and water related diseases increased due to pollution (Manzungu & Chioreso, 2012). It is evident that the ladies in photo-narrative have become accustomed to the water pollution (*they seem unaffected*) because they wash their clothes in and allow their children to play in the dirty water.

In terms of learning about EE PSGTs in group C have realised the magnitude of water pollution by observation and arrived at deductions about water pollution, water borne disease, and hygiene practices of people living along the Mucheke and Shagashe rivers. They have become aware of the plight of women where they multitask with domestic chores while overseeing their children. Further, the group realised the mothers lacked education about waterborne diseases, especially where their children were concerned (*are filling their mouths with the dirty water and squirting it onto each other*).

To address the growing problem of water pollution, group C planned to educate the public of Masvingo about water, the need to use it sparingly and not polluting it.

7.5.2 Implementation of Plan 1

Group C decided to implement a plan to combat water pollution by trying to propagate the notion of communal ownership of water as a community resource. In other words water was construed as a resource that belonged to everyone (*industry, residents, vendors, squatters small to medium industries, women, men, children*) thus everyone had to exercise care when dealing with water. The plan was to disseminate information to all groups (*industry, residents, small to medium industries, women, men, children*).

It seemed like people in Masvingo were not concerned with the quality of water as long as it was available for their use (RD-Ci).

We informed them about the effects of water pollution such as death of other aquatic organisms, outbreak of diseases like cholera, dysentery, diarrhoea, reduced water flow that will affect city's water supply, pollution from pesticides and fertilizers, increased water treatment costs, water odour and poor light penetration affecting organisms that require oxygen. Some listened, smiled and nodded to acknowledge receipt of information. It felt to be good to empower the community and make what promised to be a substantial difference in people's lives (RD-Cii).

It is evident the group presented a lot of information on the effects of water pollution as shown above. During this implementation of the group's plan, the group experienced a sense of contribution based on acknowledgements through (listening, smiling, nodding) creating awareness (pollution causes diseases, death of other aquatic organisms, growth of water hyacinth, pollution by pesticides, increased water treatment works) empowering people (people felt they have been given information to make a difference in their life) (RD-Ciii).

Evaluation of Plan 1

The evaluation of the plan by group C revealed as revealed by the following data

We evaluated the impact of our awareness session with stakeholders on their actions (over one week). It appeared like the information on pollution provided did not change their behaviour, they continued to throw all sorts of litter into the river thereby causing water pollution. The squatters continued

with their bad habits, poor hygiene practices and polluted the river. It became more confusing because they smiled, nodded, joked. We doubted if they took us seriously (RD-Civ).

From the above excerpt, it is evident that the group evaluated their plan (*observing their actions over a week*) in the targeted community (*squatters, vegetable vendors, residents, SME (Small to medium Industries) as a result of unemployment*). The observation led the PSTGs to question the effectiveness of plan 1 (*We doubted if they took us seriously*). At this stage PSSTs learnt about EE by observing (*throwing litter at the banks of the river, growing of crops, dumping scrap metal at the banks, living a life without toilets, running water*) evaluating (*impact of our sharing information sessions*) and reaching conclusions (RD-Cv).

Reflections on Plan 1

The group met to reflect on their first plan to combat water pollution in Masvingo as can be seen in the excerpt below:

Our first plan to share information about water pollution was a noble but futile exercise. The information shared was too technical, too much to an informal settlements of a mixed background in terms of educational background, level of appreciation. Some information was not suitable to their level, besides the targeted groups were a mixture of individuals with varying interests, some having been street kids who live a don't care type of life. At the market we realised that some people were just passing by without any serious business at the market so we ended up sharing information to customers and passersby (RD-Cvi).

In the reflection phase PSSTs learned by reviewing plan one (*failed to produce intended action*). They reflected on their emotions (*saddened*) and effort (*became ineffective*) as part of the learning process. The pre-service geography teachers acknowledged the flaws of the first plan (*giving too technical information to an informal sector*) and sought to remedy their flaws (*use well thought out methods of sharing based on analysis of their level of education, business interests at the market, background of many squatters*) (RD-Cvii). The learning that occurred during the reflection phase heightened PSSTs awareness of the suitability of methods used in EE, the target population, the background of people, their level of education, and the mixed nature of audience. *In the learning process what comes to the fore is the level of awareness an individual acquires over time and be able to convert the information into pro-environmental information to communities instead of the group to take the lead (RD-Cviii).*

7.5.3 Intervention Plan 2

Implementation of Plan 2: Recycling of solid waste

Group C approached the local Council, the EMA, Masvingo Technical College (MTC) and a Zada, a local construction company to assist with plastic recycling. The Council and EMA agreed to supervise the environmental work in the town, after observing that most youths at the camp did a lot of sorting of plastic empty containers, which they sell to big companies. MTC designed a machine to make the bricks, which the group used. Zada agreed to provide river sand free of charge. The excerpt below from a reflective diary confirms the sourcing of the machine from MTC:

We assured council, EMA and the brick moulder that we had already talked to MTC about getting the machine, pledging to arrange the transportation of the machine and making sure we source enough river sand for the project. We asked for their maximum support to empower this group which is polluting in Masvingo. All stakeholders were supportive of the idea and pledged to support that intervention as a better way of concentrating their attention to some useful activities and move away from environmental degrading activities along the river bank” (RD-Civ).

The excerpt above indicates the collaboration that PSTGs engaged in (Council, EMA, MTC and brick moulder) as well as the pledges they made to assist (*assurance*), the planning the group promised (*planning, transportation and the coordination of recycling at the squatter camp*) while learning about water pollution and EE. The group saw this initiative as a way of rehabilitating the youth and occupying them meaningfully, while also minimizing water pollution. In the learning process PSTGs were sensitive to contextual issues (*get empowered and run away from polluting the water*) (RDCv).

Based on continuous reflections, PSTGs were capable of expressing the concepts and sources of water pollution while embracing ideas of collaboration, community learning and addressing important community issues (*entrepreneurship, empowerment of youth, reducing water pollution*) (RDCvi). These collaborations equipped PSTGs with knowledge, skills and approaches to management and the concept of environmental sustainability.

Evaluation of and reflection on Plan 2

On evaluation of the second plan, Group C realised that important stakeholders had not fully supported the idea of empowering youth to reduce water pollution. The plan sounded good on paper, but could only work

to some extent in the absence of full support of all stakeholders. As a way, forward, a new strategy had to be considered.

In terms of learning about EE group C realised that getting the stakeholders to work together is a trial and error process, that getting each one to co-operate effectively is a long process (*it is not a simple and straight forward process*), that requires commitment from all stakeholders (*we need to try something different*). This means that learning about EE is cyclic and is similar to an experiential way of learning where a many ideas are tried until the effective ones are identified and they produce the desired result.

7.5.4 Implementation of Plan 3: Removal of water hyacinth

To experience some form of success, Group C decided to physically remove water hyacinth as shown in PN-Ciii. The removal involved using tools such rakes, pangas, hoes and chains to drag the water hyacinth to safe levels of the river. The Department of Wildlife and National Parks was consulted for the loan of equipment such as rakes and cutting equipment.

Photograph Ciii. Depicting Water hyacinth in Mucheke River, Masvingo



Water hyacinth in Mucheke River, Masvingo. The growth of water hyacinth has provided grazing for livestock (PN-Ciii).

Photograph Civ. Showing group C members removing water hyacinth



Removal of water hyacinth from Shagashe River by group members. Group members removed the water hyacinth by hand as a method. The area invaded by the weed was too big and extensive making the hand method ineffective. Besides it has grown to be a big problem that our effort only represented a small fraction of what should be done by all stakeholders. (PN-Civ)

Evaluation and reflection of plan 3

Upon evaluating this intervention the group noted the plan worked on a small scale but could not cover a substantial area, especially without buy-in from the community.

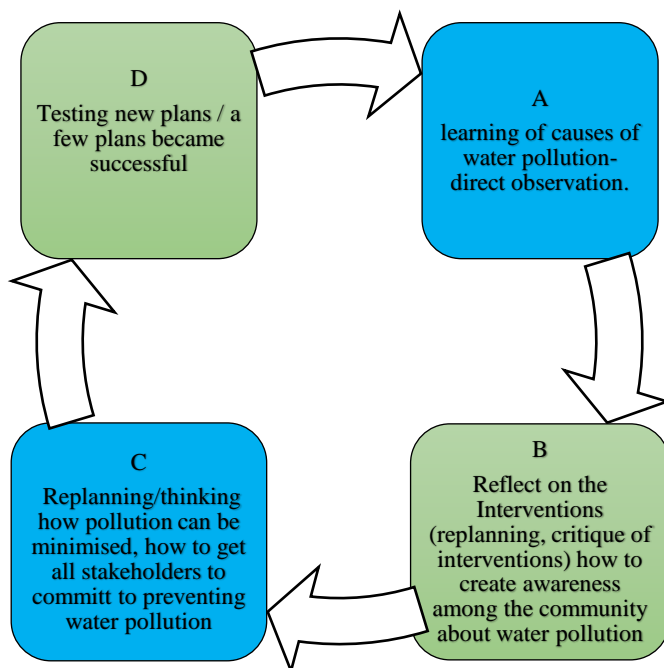
Upon reflection on this intervention the group noted that physical removal can only be effective on a small scale, especially given the small number of students (five) in the group. The group noted that while the method works to some extent, it needs to be complemented by other mechanical means of removing weeds, such as tractors or any specialized equipment, chemical means by use of herbicides that do not harm other organisms in the river.

More studies are need on the best methods to eradicate water hyacinth in Mucheke and Shakagashe rivers as a matter of urgency given the rate at which it multiplies. Activities such as disposal of effluent from industries should be discouraged at all costs. More importantly urban farming, squatting youth, dumping of metal waste into the river banks should all be discouraged. Efforts to provide toilets and running water at the squatter camp should be intensified. More plans are needed to reduce water pollution in the upstream (RD-Ciii).

7.5.5. Summary of the application of ELT and PAR in experiencing of and intervening on water pollution

In this EE project, the group C PSGTs had learned of sources of water pollution from industrial effluent, empty plastic containers, sewage disposal, urban farming, squatters, vegetable vendors through observation. They learned of ethical consideration when taking photographs of potential pollution sites, by observing research code of ethics. Through their own reading they learnt sources of water pollution that feed the growth of water hyacinths. They linked their knowledge of socio-economic disadvantages in informal settlements to the high youth unemployment rate, which leads to a lot of water pollution along the river. Through reading and observation they learnt that water pollution as an environmental challenge that involves almost all residents in terms of sources and solutions. Through planning an intervention, they learnt that to address the problem you need the support of all residents from vegetable vendors through to industrialists. They learnt about the importance of environmental consciousness raising by making the community aware of pollution of the river. Through planning they learnt of the value of collaboration and commitment from all stakeholders to resolve the challenge. Through planning, reflection and engaging in action, they learned that to successfully remove water hyacinth you need to involve all key stakeholders such as the Council, EMA, biologists and researchers.

Figure 29 Kolb's Learning Cycle for group C



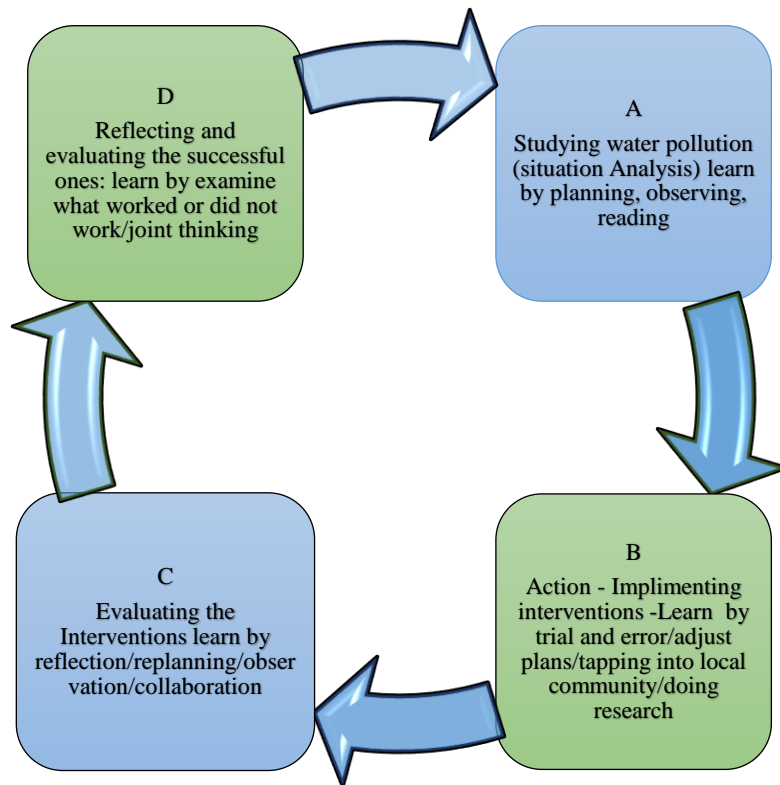


Figure 30 Participatory Action Research Cycle

The above figures explains how group C addressed the challenge through ELT and through PAR in their participation in the interventions.

7.5.6.Summary of group C

Group C learnt water pollution, implemented several interventions such as involving council, government organisations responsible such as EMA, National Parks, educating the public to the removal of water hyacinth. Some interventions worked while some failed.

7.6 Group D: Bursts sewerage in Masvingo urban area.

7.6.1 Identification of problem

The main cause of burst sewage pipes according to a group D were:-

- The design of the sewerage system being unable to withstand rapid population increase in Mavingo, that is too many people per unit or house resulting in sewer line blockages.
- Breakdown of both sanitation and potable water systems resulting in an irregular water supply to residential areas.
- Most sewage treatment works are old and are poorly maintained, so are also overdue for rehabilitation.
- Residents plant trees along the sewer system, but the roots of these trees cause cracks in the sewer system.
- Poor workmanship by council workers.
- Use of poorly manufactured pipes that crack easily.
- Shallow depth of the sewer system in relation to type of soil, so pipes crack easily due to heavy traffic.
- Unsuitable solid waste has also been flushed into the sewerage system, which clogs the system leading to sewage bursts.
- Disposal of insoluble materials in the drainage system.
- Vandalism on the drainage system.
- Lack of maintenance of the sewerage system.
- Allocating residential stands in wet lands means more people using the sewerage leading to overuse of the sewerage.
- Use of plastic material as toilet tissues,.
- Baby diaper dumping into the sewerage systems.
- Urban agriculture loosens the soil and make prone to erosion that takes soil into the sewerage system

Photograph Di: Showing sewage leakage in Mucheke residential area



Sewage leakage in Mucheke residential area. The system fails to accommodate more sewage flowing in it causing the manhole to burst. The problem points to blockage in the system caused by poor maintenance by municipality, small pipes and old age of the sewer system. Children are exposed to sewage. (PN-Di)

Photographs Dii. Showing sewage flowing in the residential area.



Raw sewage from burst pipes, man holes flows freely in streets and around houses in Masvingo urban. This flow of sewage is a breeding ground for water borne diseases such as cholera, dysentery, typhoid and malaria and is a menace to the public. The stench is unbearable and breathing becomes difficult. People are forced to stay indoors, some people homes are surrounded by sewage and they cannot even leave. (PN-Dii)

Photo-narratives illuminates the unhygienic conditions (*stench is unbearable, breeding ground for water borne diseases*) and appalling service delivery (*by poor maintenance by municipality*) residents of Masvingo have to contend with when sewage pipes burst or overflow.

The excerpt from the reflective diary verifies the data from the photo–narrative.

Residents are powerless when they are surrounded by sewerage flowing around their homes, many house hold chores cannot be done. Children are forced to stay indoors, they cannot play in their yards or streets, the stench is unbearable it becomes impossible to cook or eat with the stench and flies (RD-Di).

The restrictions (*children are forced to stay indoors, house hold chores cannot be done, impossible to cook or eat with the stench and flies*) that the residents encounter when sewerage pipes burst and sewage flows freely in streets and around homes becomes evident in these extracts.

The identification of the above environmental challenge resonates well with studies conducted in Zimbabwe by Mangizvo (2011), Makwara and Tauyanago (2013), Chinyama and Toma (2013) and Chirisa, Nyamadzawo and Bandaiko and Mutsindikwa (2015), which found that sewage bursts are a major source of water-borne diseases in urban areas. These studies found that 80% of Zimbabwe's cities are faced with burst sewerage pipes due to poorly maintained sewer systems, which is exacerbated by residents not being able to pay their rates due to high level of unemployment and growth of urban populations due to urbanisation. The studies point to an increase in the number of outbreaks of water-borne disease such as cholera, dysentery and typhoid.

Group D planned to educate the public about items that obstruct sewage pipes and the consequences of overflowing sewage pipes.

7. 6.2. Intervention plan 1

To address the problem of burst sewage pipes Group D decided to share information with the residents of Masvingo on items that can cause blockages to domestic sewer pipes and the consequences of burst or overflowing sewerage pipes. The excerpt from the reflective diary reveals how the envisaged plan unfolded.

As a group we spoke to plumbers to find out about the various kinds of pipes used in sewerage systems, we consulted Unilever to find out about detergents that cause blockage of drains as part of our planning for the intervention. We held meeting with the pastors to seek permission to address the church congregation after the Sunday church service. The pastor encouraged us to get the community to learn to help themselves, to care for their surroundings. We shared information with the residents about the effects of burst sewage pipes, and how they have a role to play in ensuring that they do not get blocked or burst. The group highlighted the possibility of diseases such as cholera, dysentery, typhoid, internal worms resulting from drinking sewer water. They listened quietly as if they understood when we spoke of using simple stuff like vinegar, lemon juice found in a home to serve as a cleaning agent. It felt good to be involved in empowering the community and make a big difference in people's attitude towards burst sewage bursts (RD Dii).

From the above excerpt it can be seen that group D shared a lot of information with the community (*effects of burst sewage pipes, and how they have a role to play in ensuring that they do not get blocked or burst about diseases, using simple stuff like vinegar, lemon juice found in a home to serve as a cleaning agent*). The residents were voiceless in the information sharing session (*They listened quietly*), The voices of the PSGTs were privileged. During the implementation of their plan they experienced a sense of achievement based on verbal and nonverbal responses received from the community (*they listened,*).

It is evident that during the implementation stage PSGTs learnt about EE by collaborating with experts (*spoke to plumbers to find out about the various kinds of pipes used in sewerage systems, we consulted Unilever*). They also learnt by doing research and reading on water-borne diseases.

Evaluation of Plan 1

The evaluation of the plan by group D revealed:

We evaluated our information sharing with community members by observing the results over two weeks through reports from the Masvingo Council's department of engineering that are released every Thursday. It seemed as if the information we shared with the community were ignored, burst

sewage pipes continued, with more sewer water being released into the streets. We are confused the community seemed to have understood, they listened quietly. Maybe them being quite meant they didn't understand and were refusing to buy into our plan I doubt they understood (RD-Diii).

From the above excerpt, it is evident that the group evaluated their plan by observing the actions of residents (*observing their actions*) of the community they had addressed. The observation led the PSGTs to question the effectiveness of their plan (*doubt they understood,*).

At this stage PSGTs learnt about EE by observing (*more sewage burst pipes, more street sewage flowing, more disease outbreaks, more blockages*), research (*reports from the Masvingo Council's department*) evaluating (*impact of our information sharing sessions*) and reaching conclusions.

Reflections on Plan 1

The group met to reflect on their first strategy to fight burst sewerage pipes as is evident in the following excerpt:

Our effort to educate the community about burst sewage pipes failed dismally, we were saddened that our effort invested was futile. May be we need to be more inclusive of the community and ask for their opinions so that they feel they are a part of the project, need to hear their voices. We need a simple but effective strategy (RD-Div).

In the reflection phase PSGTs learnt about EE by reviewing their plan (*failed dismally*). They reflect on their feelings (*saddened*) and effort (*was futile*) as part of the learning process. Group D learnt that their top down method of information dissemination did not work in this community. PSTGs came to acknowledge the flaws of their plan (*be more inclusive of the community, need to hear their voices*) and recognise how to remedy this flaw (*simple but effective strategy*).

7.6. 3 Intervention Plan 2

For the second intervention group D decided to approach Masvingo Council to discuss water problems in the city as residents were experiences cuts in the supply of water. Water was only available to residence in the early hours of the day and a few hours in the evening.

Implementation of plan 2: Provision of water for more hours, provision of potable water, drilling of boreholes in most residential areas

Group D engaged Council on the provision of water to residential places on a daily basis. The following options were explored as part of the second intervention:

- *Provision of water for a limited hours during the day such as 10 hours*
- *Portable water supply to residential places*
- *Boreholes in a particular cluster of residents with Jojo tanks*

Photograph Diii: Showing installed Jojo tank.



Jojo tanks can be installed in residential areas to fight frequent water shortages that residents of Masvingo encounter. They can be installed in clusters depending on water demand of the area. (PN-Diii)

Over and above the problem of burst sewage pipes the residents of Masvingo also have to deal with water shortages.

We felt if some of the ideas are implemented the problem of water supply would be half solved. The group assured council that more awareness could be done by the group to sensitise communities to own installed assets and use them in a sustainable way. The group assured Council of further co-operation to source assistance from the corporate world in the form of borehole hand pumps, jojo tanks, bricks for building blair toilets. To some suggestions Council was supportive while they did not agree with some. Council appraised the group of the mandate sought from councillors on such projects, but assured the group that efforts will be done to contain the problem. The group felt good to make suggestions that can lead to the betterment of people's living conditions (RD-Dv).

The excerpt above reveals suggestions made by the group when they engaged Council (*provide alternative sources of water such potable water supply, boreholes, build blair toilets, build more public toilets, provision of water for certain number of hours at least 10 hours*) as well as pledges to assist council sourcing help from the business world (*assure council of the assistance*) while learning about burst sewerage pipes and EE. The group saw some of the suggested measures as ways of reducing the environmental challenge of burst sewerage pipes and ensuring a clean environment for residents. In the learning process they were sensitive to contextual issues (*to own installed assets and use them in a sustainable way*).

Based on the reflections, PSGTs were capable of making suggestions that could be implemented as solutions to burst sewerage pipes, while embracing ideas of consultations, collaboration, community engagement and developing responsible environmental behaviour among residents. These engagements and collaborations equip PSGTs with the knowledge, skills and approaches appropriate to management of council affairs in the context of understanding environmental sustainability, especially in terms of burst sewerage pipes and impact of those on human health.

Evaluation of Plan 2

The group's evaluation of plan 2 reveals:

Although the group suggested a lot of possible solutions to water problems, it is only the Council's health department that can drive the process through a full council meetings, budget and any relevant stakeholders. Council did not buy our suggestions totally. The group felt some could be implemented in the short term while others might take time. It was a bit disappointing to the group as students we learnt the problem and also investing our time in the project with the hope of making an impact. Our effort was not much appreciated as a result we need to try something different to get Council to change and start implementing sustainable solutions to the water and sewage problem. It is not as simple suggested and taken as quickly as possible, is not a straight forward process (RD Dvi).

It was upon evaluation of their second plan that Group D realised that the community did not seriously consider their suggestions for stopping burst sewerage pipes and for beginning a new chapter of a healthier environment. The plan would work to some extent, but only if implemented with support from people and councillors. This disappointed the group when they realised that their efforts had not been taken seriously. As a way forward group D decided to try a new strategy to change Council's attitude, encourage the community to halt sewage burst pipes and so start on a healthier path.

In terms of learning about EE group D realised, it was a trial and error process. They found that creating a sustainable environment involved many stakeholders besides council workers (*it is not a one station effort and not a straight forward process, its bureaucratic in nature*) many ideas and many strategies (*we need to do something different*). This meant that learning about EE was similar to problem solving as it characterised by varied attempts, until success is achieved.

Reflections on Plan 2

Some reflections on plan 2 by PSGTs were as follows:

We need to get all relevant Council departments such as Health and Engineering to be involved in the identification of the sources of sewage burst pipes and work with them throughout so that ideas put forward can to some extent be accommodated at a higher level. A lot of stakeholders are involved in solving sewage burst pipes. There is need for a buy-in from the community to produce sustainable solutions to sewage problems (RD-Dv).

As can be seen from the excerpt above, the group decided to include two important council departments, namely Health and Engineering, as part of the broader strategy of solutions to be suggested later, which they hoped would be taken more seriously.

In terms of learning about EE the group realised the need to re-shape their third plan based on their experience that PSGTs alone cannot influence decisions that are technical in nature. Group D reflected on the consequences of their efforts in the second intervention of reducing the extent of sewage burst pipes and so starting to create a healthy environment for Masvingo city residents. Group D realised the need for collaborations and systems thinking (*the need to include Health and Engineering departments who are key players*) when solving environmental issues such as burst sewerage pipes.

7.6.4 Intervention Plan 3

Implementation of plan 3: Installing of bigger diameter sewage pipes in all residential suburbs

The group decided to approach Council with an idea of installing a bigger diameter sewer system that could minimize burst sewerage pipes in residential areas. Through a discussion group D realised that Council was already in the process of putting in place the bigger sewer system for all residential areas. The ideas about improving water supplies (*provision of water for some hours, portable water supply, boreholes in cluster, use of blair toilets, building more public toilets at the market places and bus terminus*) would dovetail well with this big project.

Photographs Div: Showing larger sewage pipes that were being installed in Masvingo



The bigger sewer pipes would alleviate the problem of sewage burst pipes to some extent because the capacity of the system would have improved. However, it is the water availability that enables the movement of sewer along the pipes, therefore water should be made available in residential areas as a matter of urgency. (PN-Div)

Evaluation of plan 3

On evaluation of the third plan, the group realised that it would work well if there were significant improvements in water supply (*through the main system, boreholes, portable water supply, use of blair toilets, construction of more public toilets*) with a variety of ideas for improving the supply of water. The plan could also be complemented by educating all residents. Full co-operation from Council departments (*Health and Engineering*) would go a long way to alleviate the problem. The bigger sized pipes would cater for future increases in populations. Therefore, the group welcomed the idea to alleviate the problem.

Reflections on plan 3

In reflecting on this intervention, the group noted and hoped that to some extent it would alleviate the problem of sewage burst pipes in residential areas. The first complementary activity would be to mount educational awareness campaigns for residents to sensitise them to the need to look after the sewer system, and that it is possible to reduce problems caused by sewage bursts by installing bigger diameter pipes. A lot more work should be done to educate the public on the implications of sewage bursts on their health (*disease outbreaks such as cholera, dysentery, malaria, pollution of water sources*) of all people. The group was convinced the plan would produce good results in future in terms of creating a healthy environment for all residents. Council implemented the plans to augment water supplies. The group learnt about the value of involving all residents in all Council developmental plans, especially those directed at solving environmental problems because such problems have their roots in society ,that is they have a social origin. In terms of learning about EE the group learnt that it is an on-going process. The capacity of PSGTs to act as catalysts of environmental change concerning burst sewerage pipes in relation to their community is grounded in real world contextual experiences.

7.6.5. Summary of the application of ELT and PAR on burst sewage pipes by group D

Group D experienced EE through burst sewerage pipes in the Mucheke suburbs. The group learnt about and analysed the causes of burst sewerage pipes, as shown through photo-narratives and reflective diaries

above. In the application of ELT and PAR, the learning in which pre-service geography teachers were involved can be summarised as follows.

Learning by immersing themselves in the community context and engaging with residents.

Learning by discussing infrastructural challenges with skilled plumbers.

Learning by reading up on waterborne diseases Learning through collaboration and planning that they could tap into resources from city departments.

Learning by consulting with corporate organizations that specialise in production of detergents.

Learning to appreciate the water needs of the community and respond to these needs by providing alternative water sources.

Learning by communicating with residents.

Learning through observation that once communities are deprived they would resort to any source of water, such as open wells.

Learning that EE is an on-going process; that there are no quick fix solutions. Success is achieved through repeated trial and error interventions. It calls on understanding communities; that is, their immediate water needs and their resources, the cultural context of what people can do in the event of shortages. Figures 31 and 32 show the application of ELT and PAR in resolving the challenge of burst sewage pipes by group D.

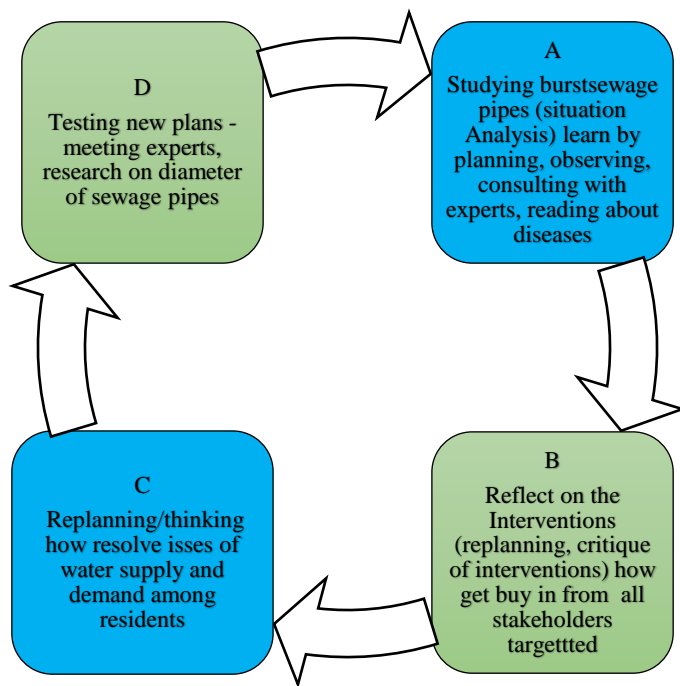


Figure 31 Kolb's Learning Cycle for group D.

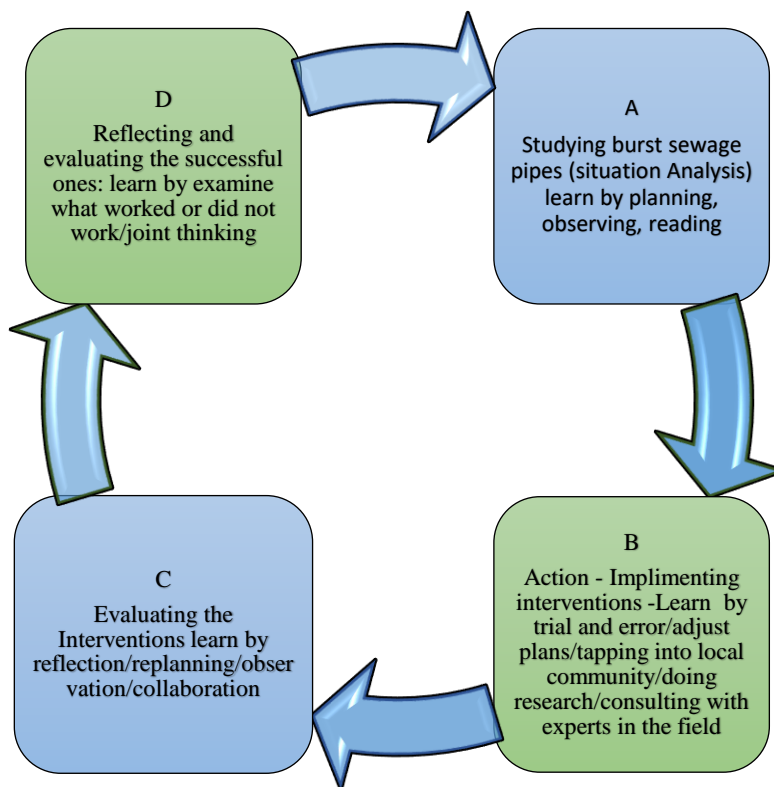


Figure 32: Participatory Action Research Cycle

7.6.6 Summary for group D

Group D learnt sewerage bursts as caused by growth in population, vandalism of property, unplanned settlements in water ways. Developed several interventions such as educating the public, involving council departments of engineering and health. The group noted some progress is being made to ease the problem by increasing diameter of sewerage pipes.

7.7 Summary of Chapter 7

In order to answer Research Question 3 concerning how pre-service geography teachers learn environmental education, the chapter reports on the environmental challenges identified by the four groups of PSGTs and how they planned to address these challenges. Group A focused on deforestation, group B attended to poor disposal of solid waste, group C concentrated on water pollution and group D paid attention to burst sewerage pipes. The findings foreground the multiple ways by which PSGTs learn EE when they engage in experiential learning and action research. Some of the avenues of learning EE include immersion in community contexts, discussing infrastructural challenges face-to-face with local council officials, understanding the problems of water availability, appreciating that learning is an ongoing process without quick solutions, learning to be ethical when dealing with residents, appreciating problems faced by informal settlements, using influential people in society such as church pastors. The next chapter will summarise the results of the thesis; I make conclusions and recommendations based on this study.

CHAPTER 8: FINAL INTERPRETATION, SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The focus of this chapter is to provide a review of findings and recommendations from and conclusions to the qualitative study. The analysis of the findings, which were produced using diverse data generations methods. The study, which aimed to explore pre-service geography teachers' understanding of environmental education at the Lowveld University, was underpinned by three research questions: first, *What is pre-service geography teachers' understanding of environmental education?*, second, *What are pre-service geography teachers' attitudes towards the teaching of environmental education?* and third, *How can pre-service geography teachers learn environmental education?*

8.2 Summary of key research findings

8.2.1 Findings for Research Question 1

Table 2 Summary of findings from Research Question 1

Research Question 1	Overall finding	Themes
What are pre-service geography teachers' understanding of Environmental education?	Pre-service geography teachers view EE as education that teaches people to conserve natural resources for the good of present and future generations.	EE teaches people to conserve natural resources and use them in a sustainable way (intergenerational equity) EE develops understanding of human interactions with the environment, human impact on the environment (socio-economic benefits) EE develops understanding of the Earth's processes EE develops skills in science and geography EE promotes safe sustainable interaction between humans and the environment

Theme 1: EE teaches people to conserve natural resources and use them in a sustainable way (intergenerational equity). In the concept of using natural resources sustainably, the needs of the present and future generations are important. Each generation is equally entitled to a share of resources.

Theme 2: EE develops an understanding of human interactions with the environment. It also develops an understanding of human dependency on the environment (socio-economic benefits). In this understanding of EE, participants viewed humans, plants and animals as dependent on the environment for their survival. Theme 2 highlights that pre-service geography teachers' ideas that it is essential for learners to be taught EE, because EE creates awareness of our survival's dependency on the environment, and so that we can make a substantial difference by our actions, in order to maintain and conserve the Earth's biodiversity and prevent problems such as destruction of wetlands and species extinction. Failure to appreciate environmental relationships would affect humanity negatively.

Theme 3: EE develops an understanding of the Earth's processes of hydrology, geomorphology, biogeography and climatology, which is important because it enabled participants to appreciate the impact of humans on the environment. Because these natural processes give rise to life support systems, that appreciation gives a focus to behaviours that can harm the environment.

Theme 4: EE develops skills in science and geography. Science develops skills such as observing, collecting, experimenting, comparing and investigating, which lead to the development of skills in EE such as critical thinking, analytical thinking, problem solving and decision making, which are the foundation for environmentally conscious citizenry making informed decisions. Environmental education, which focuses on seeking practical solutions, is fundamental in enabling pupils to tackle environmental issues from early grades, which in turn would influence positive pro-environmental actions. Such learning is pragmatic and responsive in solving local environmental problems. These ideas resonate well with observations that participation in solving environmental problems is the central and the goal of EE and ESD (UNESCO, 2004, 2005).

Theme 5: EE promotes safe sustainable interactions. Humans through activities such as agriculture, urban development, mining and construction have affected the environment in many negative ways. Dams built for water supply and hydroelectric power production have interrupted sediment movement along rivers. A range of all these human activities and their environmental impact have prompted the call for EE to develop

safe human-environment interactions through the cultivation of desirable human habits that protect the environment with minimum damage.

8.2.2 Findings for Research Question 2

Table 3 Summary of findings from research Question 2, enabling and constraining factors for EE teaching and learning by pre-service teachers

Research Question 2	Overall finding	Themes
<p>What are pre-service geography teachers' attitudes towards the teaching of Environmental education?</p> <p>2.1 What factors enables the teaching of EE?</p> <p>2.2 What factors constrain teachers in teaching EE?</p>	<p>Pre-service geography teachers are of the view that adequate knowledge (PCK) and positive attitude about EE is a prerequisite to positively teaching and learning EE</p>	<p>1. Pre- service geography teachers view adequate knowledge as an enabling factor (PCK)</p> <p>2. Positive teacher attitude</p> <p>1. Inadequate training related to PCK in EE</p> <p>2. Lack of resources</p>

For Research sub-Question 2:1: What factors enable the teaching of EE? The following two themes emerged:

Theme 1: Adequate knowledge as an enabling factor (PCK).

Participants were of the view that pre-service geography teachers should have sufficient subject matter knowledge on conservation of natural resources to teach EE effectively. Adequate knowledge is foregrounded in the notion that it promotes development of positive ways of interacting with the environment by the teacher, which will then influence their learners. These ideas resonate well with those of Borhan & Ismail (2011) and (Skanavis, Petreniti & Giannopoulou, 2004) are that besides the acquisition of knowledge, dexterities and positive perceptions, formal education cultivates ways of thinking and behaviours . Evidence from many scholars suggests that pro-environmental behaviour is predicated by knowledge and education (Barr, 2007; Weaver, 2002). Knowledge gained from EE is considered to be an essential component of education for future citizens, in order for them to be able to deal with environmental issues they may encounter.

Theme 2: Positive teacher attitude. Participants were of the view that pre-requisites to teaching are that teachers need to be motivated and have an appropriate attitude to handling environmental issues. Environmental attitudes are defined as the predispositions that affect how someone perceives and interprets the physical, social and cultural conditions that affect the development of an organism (De Chano, 2006). Positive teacher attitudes are a result of the teacher's knowledge of environmental issues. Therefore, teachers should be exposed to sufficient knowledge to enable them to teach EE effectively.

For Research sub-Question 2:2: What factors constrain the teaching of EE?, two themes emerged, which are discussed below.

Theme 1: Inadequate training related to PCK in EE. Participants were of the view that inadequate pedagogical knowledge from their initial training affects their ability to teach EE. Teachers should have knowledge of the subject matter (SK) as well knowledge about instructional strategies in order to enable their students to construct learning meaningfully. Therefore, teacher training institutions should ensure that teachers receive adequate training with regard to both subject matter knowledge and pedagogical knowledge related to EE. Many studies have found inadequate teacher training on EE as the major weakness in teachers both practicing and pre-service teachers.

Theme 2: Lack of resources

Most schools in Zimbabwe are under-resourced and hence cannot provided the specific resources needed to teach geography such as maps, globes, money for field trips. Many topics in geography require teaching EE from a global perspective. Studies on bioenergetics, nitrogen, carbon and oxygen cycles that fundamentally, hydrology, water sources and catchment management cannot be studied without field trips.

8.2.3 Findings for Research Question 3

For the question; How do pre-service geography teachers learn EE? The four groups A, b, C and D identified different environmental challenges to try and address, as summarised next.

Group A studied deforestation in Masvingo peri-urban area. In order to address the challenge the group planned and carried out three interventions. They first addressed the community about the impact of deforestation. Having realised the flaws in their original plan the group then included the church pastor, the Forestry Commission and the EMA in the execution of their subsequent plans to influence the community to be involved in reforestation.

Group B studied poor solid waste disposal in Masvingo urban area. They recognised the causes of poor solid waste disposal and planned interventions such as burning the waste and consulting with Masvingo municipality to increase the provision of bins in the market area, which more than 200 people visited daily.

Group C studied water pollution in the Mucheke and Shagashe rivers. The group planned public education on the dangers of water pollution, especially directed to squatters along the two main rivers, small to medium industries, and vegetable vendors.

Group D had identified burst sewage pipes as an environmental challenge in Masvingo. To address the problem they consulted with skilled plumbers, corporate business involved in manufacturing detergents, conducted research, and had meetings with the Masvingo municipality.

Table 4 Summary of findings from Research Question 3

Environmental challenge	How group A learnt EE?
Deforestation (group A)	<p>Group A learnt through the following activities:</p> <ul style="list-style-type: none"> • Learnt by collective reflections brings about understanding of certain insights such poverty, unemployment, lack of access to energy • Learnt by engaging people like the Pastor to reach people and therefore such individuals become useful resource • Learnt by giving too much theoretical/ technical information to an informal sector does not bring about the intended change • Learnt by collaborating with environmental organizations such as the Forestry Commission, EMA and Council. • Learnt by engaging, reading , and observation that improvised people require resources such as seeds/ seedlings/ plants/ transportation to fully engage in the rehabilitating the environment

Poor Solid Waste disposal (group B)	Group B learnt through the following activities: <ul style="list-style-type: none"> • Learnt by sharing information with community members • Learnt by burning waste in, outside the bin and burning by use of old oil • Learnt through regular collection of waste by council • Learnt by involving stakeholders such as Council • Learnt by trying compost making of perishable vegetables
Water pollution-undertaken by group C	Group C learnt through the following activities <ul style="list-style-type: none"> • Learnt by interviewing vendors and the local community about sources of water pollution from industrial effluent, empty plastic containers, sewage disposal, urban farming, squatters, vegetable vendors through observation • Learnt by taking photographs of potential pollution sites, by observing research code of ethics. • Learnt by reading about sources of water pollution that feeds the growth of water hyacinth. • Learnt by linking their knowledge of socio-economic disadvantage and informal settlement context to high unemployment rate of youth leading to a lot of water pollution along the river • Learnt by reading and observation that water pollution as an environmental challenge involves almost all residents in terms of sources and solutions • Learnt by planning an intervention, to address the problem, you need the support of all residents from vegetable vendors to industrialists • Learnt by making community aware of pollution of the river.

	<ul style="list-style-type: none"> • Learnt by planning the value of collaboration and commitment of all stakeholders to resolve the challenges • Learnt by planning and reflection and engaging in action, they learned that to successfully remove water hyacinth you need to involve all key stakeholders such as Council, EMA, biologists and researchers.
Sewage burst pipes (Group D)	<p>Group D learnt through the following activities</p> <ul style="list-style-type: none"> • Learnt by immersing themselves in the community context and engaging with residents • Learning by discussing infrastructural challenges with skilled plumbers • Learnt by collaborating/planning that they could tap into resources from city departments • Learning by consulting with corporate organizations who specialise in production of detergents • Learning to appreciate the water needs of the community and respond to needs by providing alternative water sources • Learning by communicating with residents • Learning through observation that once communities are deprived they can resort to any source of water such as open wells <p>Learning that EE is an on-going process, there is no quick fix solutions through interventions, it calls on understanding communities, their immediate water needs and what they can resort to, cultural context as to what people can do in the event of shortages</p>

8.3 Addressing the knowledge gap (New contribution from the study)

The study was distinctive in several ways. Firstly, the sample for the study was pre-service geography teachers, a relevant group of university students majoring in geography, with a view to teaching it in high schools. Geography is a natural home for education in sustainable development because it studies the processes that give rise to our natural surroundings and how humans have impacted or are still impacting on nature to disrupt its balance. Therefore, the discipline contributes significantly to our understanding of the relationship between the environment and humans. A second aspect is that, to determine PSGTs' understanding and learning about EE, data were generated through four methods; namely, a questionnaire survey, focused group interviews, photo-narratives and reflective dairies. Previous studies reviewed in the literature had no action component. In this study, groups of pre-service geography teachers engaged in a project which was informed by experiential learning theory and participatory action research. They addressed environmental challenges of deforestation, water pollution, land pollution and sewage bursts, which are current challenges faced by many urban councils due to population increase brought about by urbanization and, to some extent, industrialization. Quite distinct in this study, is the multidimensionality, that is multisensory learning, use of ELT and PAR, which is informed by the understanding that the environment is communally owned and hence challenges are caused by people and solutions should come from all stakeholders. It is clear from this study that environmental education should start from pre-school to sensitise children during their formative years in an effort to build a responsible citizenry with a wealth of knowledge about the environment. This study revealed that understanding is best developed through experiential learning. In this regard, PSGTs knowledge influenced their attitudes and ultimately resulted in active pro-environmental behaviour. This resonates with the goal of EE, which is to produce an environmentally literate citizenry, as put forward by UNESCO (2005).

A significant finding of this study is that PSGTs' confidence levels, moods and emotions affect their cognitive ideas about EE in the geography curriculum, as well as their understanding, selection and application of the teaching strategies. Therefore, the study revealed that PSGTs' understanding of EE is a function of both the cognitive domain and affective domain.

It is evident that PSGTs used their emotions and confidence to facilitate their understanding of EE. Therefore, emotions, which are underpinned by values and ideals, influenced PSGTs' understanding and learning. It can be inferred that teachers are more than subject matter specialists familiar with subject content knowledge and pedagogical knowledge, but they also, significantly, carry their own disposition into

the classroom. It can be argued that the teachers' disposition in an innate part of who they are, which impacts their intuitions, their ability to make judgements, how they develop content, how they interpret curricula, how they improvise and respond to different contexts and how they reflect on these contexts. It is acknowledged that while PSGTs' perceptions (ability/confidence) had mediated their understanding of EE, the affective component (emotions/attitudes/values/beliefs) contributed significantly to their body of knowledge and how it is operationalised.

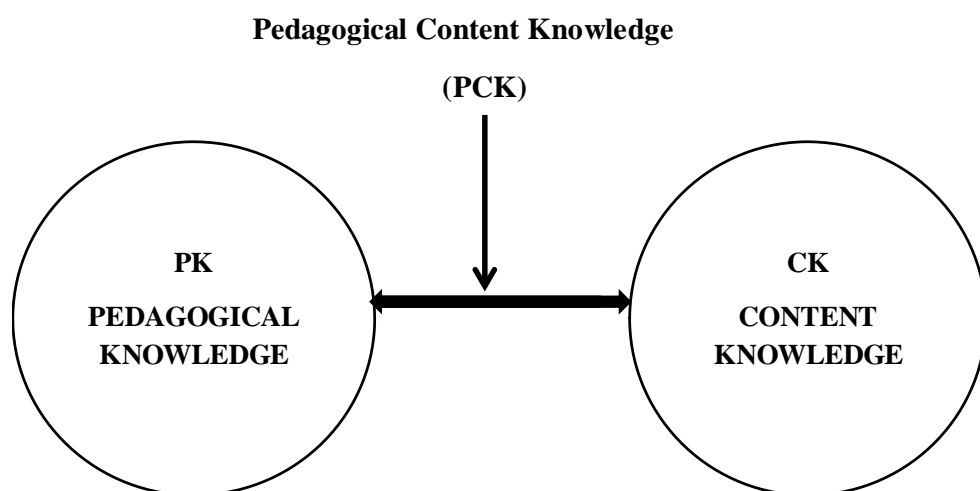


Figure 33 Old PCK Model with only PCK

New PCK Model

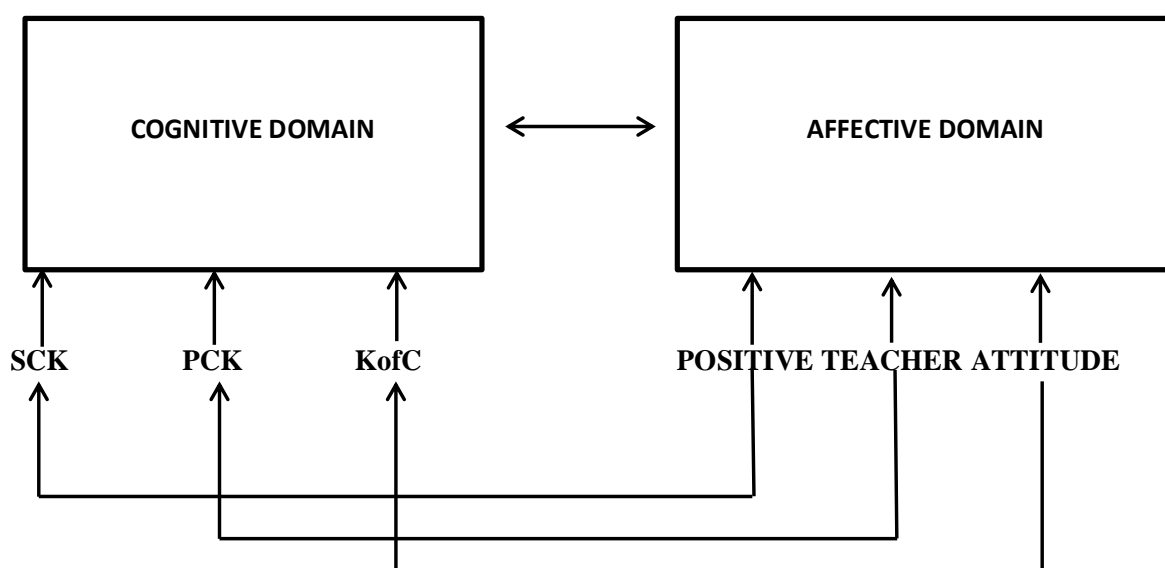


Figure 34 Comparison of old and new PCK models

In the old model of PCK, as shown in the Figure above the cognitive domain is affected by SCK, PCK, KofC (Knowledge of context). In the new model the cognitive domain is also influenced by the affective domain, which has teachers' attitudes as a central feature.

8.4 Recommendations for University Teacher Education Departments

The study recommends that PSGTs be given the space, time and opportunity, as well as resources to engage fully with environmental challenges in community settings.

8.5 Recommendations for the University Geography Educator

In environmental education, teachers' knowledge of environmental issues forms their subject matter knowledge and pedagogical content knowledge, which they draw on to teach learners. Teachers are instrumental in any educational change or innovation and its implementation. What the teacher knows is likely to be transmitted to the class. Environmental education is understood to be education *About, In, and For* the environment. Whatever methods teachers' use, be it fieldtrips, project method or hands-on experiences, they should take into consideration the fundamental characteristics of EE. Education *about* is scientific understanding of ecological processes, facts, interactions. Knowledge of these can be gained frequently through fieldwork, where the use and application of experiential ways of learning is foremost, with the notion that such deep understanding would enable learners to fully appreciate the human impact on the environment and, hence, the need to conserve natural resources. Education *In* implies the use of the environment itself as a teaching resource, where children engage with the environment in order to fully understand its process, and how the natural process depend on each other for continuity. Therefore, the natural environment is a learning laboratory for environmental education. Education *For* implies the development of values that are pro-environmental. No education is value free or neutral, every form of education serves a particular interest group and therefore value-laden EE is no exception. Values are nurtured in students over time. It is only through experiential ways of learning that such values are developed. The geography lecturer has to take these threads of EE into account when planning his or her development of the teacher, so that the ideas can be translated for learners in the school system.

Geography lecturers who teach EE section should develop curriculum which enhance the teachers' SMK and PCK in EE. Kof C is also key. Curricula should be designed to enable PSGTs to immerse themselves in community contexts in order to understand environmental challenges deeply. This learning is by doing, interacting, planning, implementing plans, reflecting and refining plans which should be experiential in nature and this opportunity should be afforded to PSGTs

8.6 Recommendations for Participation by Environmental Stakeholders in the Provision of Services

Existing municipal departments and organisations concerned with environmental issues ought to be galvanised into delivering services to residents.

8.7 Recommendations for Environmental Management Agency (EMA) and Local Authorities.

In response to the recommendations of various Earth Summits, the Zimbabwean government passed the Environmental Management Act of the following years, 13/2002, 5/2004 and 6/2005. Chapter 20:27 of the act provides for sustainable management of natural resources and protection of the environment, and prevention of pollution or any form of environmental degradation. It clearly states that pollution is a serious offence, for which a transgressor may be charged and fined by Environmental Management Authority (EMA). That act led to the enactment of many pieces of legislation to monitor and control pollution, related to Parks and Wildlife, Forestry, Water, Land and Air Pollution, Soil Erosion, Sewage disposal, Industrial waste disposal and Veld fires. These pieces of legislation are administered by local councils, so they are empowered to monitor all forms of pollution in areas under their jurisdiction and are so held responsible for any pollution.

This study recommends that EMA involve institutions of higher learning in the development of such legislation, which would enable universities to take a leading role in dissemination of information at source and so sensitize Departments of Environmental Sciences to educate students on the application of these pieces of legislation.

To local authorities, the study recommends that councils should educate people on forms of pollutions and possibly involve residents in the collection of refuse, from as early as pre-school through to universities. Businesses such as formal retail, informal vendors, companies, be they large or small to medium enterprises, should partake in clean up campaigns to internalise among their staff, the need for a clean environment.

Collaboration between government and the private sector along with universities, in cleaning up and maintaining healthy environment is recommended.

8.8 Recommendations for Further Study

In light of human dependency on the environment, the study recommends further studies on the relationship between knowledge of attitudes and pro-environmental actions. Such studies could focus on understanding of environmental education among teachers at pre-school, primary school and high school, especially among teachers who specialise in disciplines such as biology, chemistry and agriculture which are associated with EE. Further studies are also needed among learners at pre-school, primary school, secondary school and university students as well as members of the public, to determine their needs and potential to contribute to environmental health and sustainability. In particular farmers, miners, manufacturers, tourism officials, forestry officials, retailers and vendors should be studied to determine ways in which they can collaborate to maintain a safe, clean environment, for which resources are not exploited.

From the findings of this study it is recommended that research could involve government departments such as Environmental Management Agency (EMA) and local municipalities, where environments under their jurisdiction are sources of various forms of pollution. Multi-sectorial studies could investigate environmental challenges that communities are currently facing, which should of necessity involve the ‘public’, among others, sociologists, psychologists, economists and politicians, because environmental challenges have their roots in local cultures and their solutions involve many stakeholder to be effective. More importantly, studies should have an experiential learning dimension to truly engage the total human being. Experiential ways of learning has been found useful where public participation is necessary, so they may internalize problems of their making and develop solutions from their own experiences.

8.9 Limitations

The study was carried out at the Lowveld University in Zimbabwe, in the School of Education within several departments. The study relied on qualitative views of the participants whose background and experiences were diverse, as biographical data of respondents indicated. Thus data generated and the findings should not be generalized to other pre-service teachers in the same institutions, or to other institutions in the country. Further studies would be needed to validate them for other disciplines or at other

universities. A similar qualitative investigation of that population could be sought. Nevertheless the findings of this study may be useful in developing pre-service courses for teachers in geography or other disciplines, or even for university students in general.

8.10 Conclusion of the Chapter

This chapter summarized the findings that emerged from this study. The study made recommendations to teacher development departments and geography lecturers, regarding use of modern teaching methods in their pre-service teacher development.

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APPENDICES: APPENDIX 1: Ethical Clearance from University of Kwazulu-Natal



30 October 2015

Mr Daniel Gamira 213574367
School of Education
Edgewood Campus

Dear Mr Gamira

Protocol reference number: HSS/1261/015D

Project title: An exploration of pre-service Geographic teachers' understanding and learning of Environmental Education at a University in Zimbabwe

Full Approval – Expedited Application

In response to your application received on 7 September 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh(Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

cc Supervisor: Dr A Singh-Pillay & Dr Ronicka Pillay
cc. Academic Leader: Prof P Morojele
cc. School Administrator: Ms T Khumalo

Humanities & Social Sciences Research Ethics Committee

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APPENDIX 2: Lowveld University Permission



Acting Registrar

Mr. I. Chinyemba

P.O. Box 1235

Masvingo

ZIMBABWE

Tel: 039-253724

Fax: 039-252100 Cell: +263 772 177 299

**Off Old Great Zimbabwe Road
MASVINGO**

E mail: ichinyemba@gzu.ac.zw

GREAT ZIMBABWE UNIVERSITY

29 April 2015

Gamira Daniel
Faculty of Education
Department of Teacher Development
Box 1235
MASVINGO

Dear Mr Gamira

**RE: REQUEST FOR PERMISSION TO CARRY OUT DATA COLLECTION
PROCESS FOR RESEARCH PURPOSES**

The above matter refers.

This is to confirm that your request has been approved, but please note that we would request a copy of your findings too.

Wishing you good luck in your studies.

Sincerely

I. Chinyemba
Acting Registrar



APPENDIX 3: Letter of informed consent: Dean of Education



Edgewood Campus
Private Bag X03
Ashwood
3605

Dean of Education

Great Zimbabwe University

Dear Sir

My name is Daniel Gamira, I am a PhD student at the University of KwaZulu-Natal Edgewood campus. I am currently engaged in a research project entitled,

“An exploration of pre-service Geography teachers’ understanding and learning of Environmental Education at a University in Zimbabwe.”

The purpose of this project is determined pre- service Geography teachers’ understanding and learning of environmental education. I would collect data from the pre-service Geography teachers’ by multiple methods. These include questionnaires, interviews of approximately 30 minutes duration focus group interviews, portfolio of evidence (photo narratives and reflections) and document analysis. The findings of the research will not be used for any purpose other than the doctoral dissertation. The data will be stored by my supervisor and disposed of at the end of the research. Pseudonyms will be used to protect the identity of your university as well as the identity of the pre-service Geography teachers. All information disclosed will be kept in confidence. The participation in this research is voluntary and should you find that you wish to withdraw or terminate your permission for the research, you may do so without any negative consequences

Thank you.

Yours faithfully

Should you have any queries you can contact my supervisors

Dr. A. Singh –Pillay

Dr. R. Mudaly

Telephone no: 031- 260 3672

031-2603647

Email: pillaya5@ukzn.ac.za

mudalyr@ukzn.ac.za

Ms. Mariette Synmann from the Research Office may also be contacted. Her details are:

University of KwaZulu-Natal

Humanities and Social Sciences Research Ethics

Govan Mbeki Centre

Tel: +27 31 260 8350 Fax: + 27 31 260 3093 Email: snymanm@ukzn.ac.za

Acknowledgement –Stakeholders

I _____ (full name) hereby confirm that I understand the contents of the document and the nature of the research project. I grant consent for my participation in the research and for data to be collected at GZU. In doing this permission is:

- Given/not given (delete that which is not applicable) to digitally record individual interviews.
- Given /not given (delete that which is not applicable)for my lesson to be observed
- Given/not given (delete that which is not applicable) for my photo narratives, and reflective journal to be admitted in the study.

I am aware that my participation in this research is voluntary and I am at liberty to withdraw permission, should I so desire, without any negative consequences.

Signature of stakeholder

Date

Appendix 4 – Letter of informed consent: Pre-service Geography teachers’



Edgewood Campus
Private Bag X03
Ashwood
3605

Dear: Pre-service Geography Teacher

My name is Daniel Gamira I am a PhD student at the University of KwaZulu-Natal Edgewood campus. I am currently engaged in a research project entitled, “An exploration of pre-service Geography teachers’ understanding and learning of Environmental Education at a University in Zimbabwe.”

The purpose of this project is to determine pre- service Geography teachers’ understanding and learning of Environmental Education. This study is purely for academic purposes and there will be no financial gain involved. I would collect data from you by multiple methods. These include questionnaires, interviews of approximately 30 minutes duration focus group interviews and portfolio of evidence (photo narratives and reflections). The findings of the research will not be used for any purpose other than the doctoral dissertation. The data will be stored by my supervisor and disposed of at the end of the research. Pseudonyms will be used to protect the identity of your identity. All information disclosed will be kept in confidence. The participation in this research is voluntary and should you find that you wish to withdraw or terminate your permission for the research, you may do so without any negative consequences.

Thank you.

Yours faithfully

Daniel Gamira

Should you have any queries you can contact my supervisors

Dr. A. Singh –Pillay

Dr. R.Mudaly

Telephone no: 031- 260 3672

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Ms. Mariette Synmann from the Research Office may also be contacted. Her details are:

University of KwaZulu-Natal

Humanities and Social Sciences Research Ethics

Govan Mbeki Centre

Tel: +27 31 260 8350 Fax: + 27 31 260 3093 Email: snymanm@ukzn.ac.za

Phone number

Email address

Appendix 5: Data generation instruments: Questionnaire

Section A. Biographical information

1 .Gender-----

2. Age-----

3. A-level subjects-----

4. Highest qualification-----

5. Subject Majors-----

6. Part of study-----

7. Nationality-----

8. Religion-----

9. Status-----

10. Place of Residency-----

11. Geography modules covered-----

Section B

1. What does the term environment mean to you? Please explain your response. -----

2. In what ways is the environment important to you? Please explain-----

3. What do see as the relationship between the study of science and Environmental Education?--

4. What does the term 'Environmental Education' means—to you? Kindly explain your response-

5. What did you learn in Environmental Education thus far? Please explain-----

6. What topics should be included in the teaching of environmental education at schools? Please elaborate your answer.
7. What are your views towards the teaching of Environmental Education in a Geography lessons? Please explain your response.-----

8. Do you foresee any constrains /challenges in your learning of Environmental education? Kindly elaborate-----

9. How would you address these constraints?-please explain -----

10. What do think can be done to ensure that Geography teachers have the required knowledge on EE issues?-----

Section C

1. Which of the responses below, would you consider to be sources of Environmental information?

Please place a tick against the relevant responses

Government (EMA)	
Environmental groups	
Community	
Non- governmental organizations	
Industries	
Exhibitions-Agric shows, ZITF etc.	
Public campaigns	
School curriculum	
Television	
Newspapers	
Field trips	
University modules	
Other – please specify	

2. Place a tick in the block corresponding to common environmental problem/s in your community.

Water, air, land pollution	
Global warming	
Deforestation	
Biodiversity loss	
Emission of industrial gases and wastes	
Raw sewage	
Airborne diseases such as TB, Asthma	
Water borne diseases such as cholera, dysentery	
Poor waste disposal in urban communities	
Land degradation	
Soil erosion	
Siltation of water bodies	

Overfishing	
Poaching of wildlife	
Other – please specify	

3. How would you as a pre-service Geography teacher address the above environmental challenges in your community?

Why would you use such approaches?

4.

Appendix 6: Interview guide for Pre-service geography teachers

Introduction:

Pre-service Geography teachers' will be introduced to the study and be allowed to feel free to respond to the questions. They will be assured of ethical consideration that accompanies this study. The initial questions will be on:

Hobby

Favourite subject

Why that subject

Best modules in geography at university and why?

Later questions will be based on research questions the study intends to address such as outlined below:

Research questions

A. Assessing understanding of Environmental Education

1. What has been the role of geography knowledge in your life?
2. What do you understand by the term 'environment'?
3. Why study the environment?
4. What is EE?
5. What is EE in the context of Sustainable Development
6. What is the relationship between SD and ESD?
7. Views towards the learning of EE in schools especially in Geography?
8. What are your views towards EE issues?
9. Do you experience any problems in learning EE concepts?
10. Do you think EE/ ecological concepts should be part of Geography curriculum?
11. How would you enhance your overall understanding and teaching of EE concepts?

A. Assessing understanding and its influence to changes in attitudes towards environmental issues?

1. What do you identify as a common environmental challenge in your immediate community?

2. If asked to address these how would you do that, any methods?
3. Can you justify the above approaches?
4. What do feel are barriers to implementing EE in through Geography?

Appendix 7: instructions for photo narratives and reflective diaries

Work in groups of 5 (4 groups altogether)

1. Use your information about the environment challenges in communities in Zimbabwe and select an environmental challenge which you will explore
2. Conduct research about this environmental challenge
3. Design a field investigation/plan to show how you will
 - 3.1. Identify the causes and extent of the problem
 - 3.2. What you will do to rectify the problem
4. Implement your plan
5. Evaluate the implementation of the plan (record your reflections)
6. Reflect on the plan, implementation(action)and evaluation(record this reflection)
7. Refine your plan .Generate a second plan
8. Implement the second plan
9. Evaluate the implementation
10. Reflect on the plan, implementation(action)and evaluation(record this reflection)

Take photographs to show the site with the environmental problem, its causes and the site after your first intervention and then after the second intervention. Write a critical reflection based on each photograph

Example Photo set 1



Site before intervention

Reflection: Describe the site with causes etc.

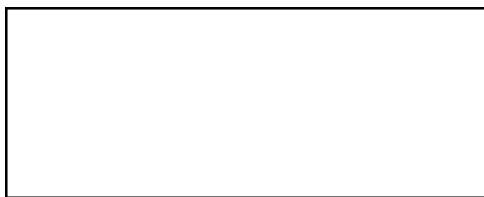
Example Photo set 2



Show how you work on this site

Reflection: why are you doing what you are doing?

Example Photo set 3



Site after first intervention

Evaluation of intervention

Reflection on action, evaluation

Re planning of intervention with reasons

Example Photo Set 4



Actions in second intervention

What are you doing and why?

Example Photo set 5



Site after second intervention

Evaluation of action

Reflection on action and evaluation of second intervention

Reflective diaries

Think about moments of transformation in terms of:

- 1. Your attitude
- 2. Your interest in EE
- 3. Your knowledge of EE
- 4. Your practice in terms of action/observation/evaluation of action/reflection.

Appendix 8: Analysis grids

1. What has been the role of Geography in your life?					2. What do you understand by the term environment?			
P	A1:	B1:	C1:	D1:	A1:	B1:	C1:	D1:
Teaches me to	help me to	develop	it provides knowledg	enable me to understan	any place around us	the physical nature	a set of social, economic,	all landscape surrounding

conserve the natural environment	sustainable and resource conserving mind	and skills in teaching EE and promotes knowledge on sustainable development	climate and weather patterns and the importance of the environment to humans	where we get food and air	surrounding us including air	physical and biological components that surround humans	us where people get a living
A2: Helps me understand the earth and processes	B2: enable me to have knowledge about the environment	C2: enabled me to understand the various components of the environment such as vegetation and buildings	D2: Helped me to understand the geographic phenomena such as use of scientific methods like observation and making sound conclusions	A2: area surrounds us including living and non-living things	B2: anything surrounding us such as mountains, rivers and vegetation	C2: things that surround us like vegetation, buildings, land and rivers	D2: area where species like animals and plants interact
A3: Helps me understand sustainability	B3: help me to understand people's interaction with the environment	C3: help me to understand spatial location of towns and cities	D3: helps me to understand migration patterns and their causes and an understanding of climate and soils.	A3: the surroundings which constitute the earth's crust and atmosphere where we get air and other resources	B3: things that surround the earth for example natural things	C3: all features on earth and their interaction with humans	D3: our surroundings where we live
A4: Enlightens me on various interactions that	B4: make me aware of how to take care of the	C4: help me to understand the distribution	D4: enables me to understand population	A4: Space inhabited by living and non-living	B4: natural such as flora and fauna and the man	C4: surroundings such as mountains,	D4: place where people and animals live

exist on the global space for example the relationship between population growth and food supply	environm ent	n of phenom ena on earth and its importanc e to humanity such as rivers and mountains	n dynamics and how to be sensitive to the environm ent	organisms supportin g each other for example rocks produce soil to sustain vegetatio n	made landscape	trees and rivers	
A5: Helps me preserve the environm ent and appreciating its natural beauty	B5: shaped me to be aware of current environm ent, where we came from and how we manage it for future generatio n	C5: Helped me with the safe interactio n methods with the environm ent and how to exploit valuable sustainabl y	D5: consci entise me about the environm ent such as where and why resources are distribute d the way they are	A5: our surroundi ngs that consists living and non-living forms	B5: surrou ndings that human beings, flora and fauna inhabit	C5: anythin g around me such as air, trees and vegetation	D5: area where human beings earn a living or an area that supports life for human beings
3. Why do we study the environment?				4. Why should we be concerned with the environment?			
A1: to know the changes and relationship between man and his environm ent	B1: to develop a mutual relationship between man environm ent	C1: to understand the relationship between man and his surroundi ngs and to gain knowledg e to solve environm ental problems and sustainabl e use resources	D1: design conservati ve measures which reduce man's degradatio n of the environm ent	A1: the earth has limited resources	B1: human activities makes the earth uninhabita ble	C1: human s' destruction on the natural environme nt is greatly increasing	D1: human beings gain a lot from the environment

A2: to have better understanding of it and to know ways of improving and conserving it	B2: to have knowledge on species and why they occupy certain areas	C2: to have knowledge on how to preserve the environment through sustainable use of resources	D2: to have an understanding of the spatial distribution of plants and animals	A2: plants and animal needs to exist like humans also	B2: in order to identify environmental problems and control and manage them	C2: manage resources for sustainability	D2: Environmental issues are of concern because humans emit pollution in the atmosphere causing climate change hence there is a need for climate change mitigation strategies
A3: to know the resources in it and how to conserve them	B3: to know the activities that can harm or conserve the environment and acquiring of new skills to address urgent environmental challenges	C3: to understand how best to interact with it	D3: to gain knowledge of environmental resources such as trees and minerals and the benefits we derive from them	A3: humans severely abuse the environment	B3: to reduce potential environmental and ecological disasters	C3: humans were meant to regulate over the nature	D3: environmental issues affect me for example soil erosion cause siltation of rivers which result in drying up of dams.
A4: to develop awareness towards the environment	B4: enable us to be aware of the dangers of causing environmental degradation and ways of	C4: to equip people with the knowledge of conserving natural resources	D4: to reduce population pressure on resources and reduce pollution	A4: to reduce the selfish of humans on human-nature interaction	B4: to reduce and minimize overconsumption of natural resources	C4: environmental problem are rising in an uncontrollable manner	D4: it's of concern because the expanding population puts pressure on resources calling for measures to reduce

	avoiding it						population growth
A5: to preserve our natural environment for sustainability	B5: know the ways of conserving finite and infinite resources with consideration of future generation's needs	C5: to appreciate the role of each component found within the environment for example the role of trees and soil	D5: to appreciate the natural landscape	A5: to help humans to adapt themselves to the conditions of nature and natural world	B5: to encourage and promote sustainable development	C5: reduction in natural resources as a result in overpopulation	D5: humans should be rational when dealing with environmental issues like pollution, erosion and deforestation to avoid environmental degradation
5. What do you understand by the term environmental education?				6. What is environmental education in the context of sustainable development?			
A1: is the learning process that increase knowledge and awareness about the environment	B1: discipline whose main focus is to provide environmental awareness to people	C1: the lifelong process of appreciating the interrelationship between human beings and nature and promotion of environmental behavior that promotes sustainability and application of knowledge from different disciplines to study	D1: is education about the safe keeping of the environment for future use	A1: both educate people about the environment but environmental education comes first followed by sustainable development	B1: deals with the rationale use of resources at minimum cost	C1: to achieve sustainable development there is need for environmental education	D1: Environmental Education educates people on the importance of the surrounding landscape

		environm ent					
A2: the process that allows individuals to explore environmental issues, to conserve and improve it	B2: it brings sustainable development since resources are utilized wisely	C2: a process that allow individuals to explore environmental issues and to engage in problem solving actions to improve the environment	D2: refers to education on species interaction in the ecosystem	A2: both protect and conserve the environment for future use in mind	B2: the two brings development to the country since resources are used wisely with future generation in mind	C2: EE teaches people to use resources wisely and carefully in order to preserve them for future	D2: if people are educated about the environment they avoid activities that may lead to the extinction species for the benefit of future generation
A3: the process of combatin g and acquiring environmental knowledge	B3: study of environmental issues for example environmental problem solving and actions that improve the environment	C3: the process of imparting knowledge on environmental issues	D3: it is about studying what is in our environment	A3: is a way of conservin g natural resources	B3: both consider the needs of future generations when using resources	C3: the impartatio n of knowledge on how best to use our environme nt	D3: they both help us in maintaining available resource for future use
A4: the study of negative and positive things that exist in the environment and	B4: is the study of the area surround us as human beings such as landscape,	C4: it's about equipping people with environmental knowledg e	D4: studie s on how to protect our environm ent	A4: both concept promote the use of natural resources without compromi sing the needs of	B4: environm ental education deals with imparting of environm ental knowledg	C4: it's about equipping people with the knowledge on the importance of conserving	D4: Environ mental education gives us awareness on issues like erosion and siltation and on how to reduce them

ways of coping with them	flora and fauna			future generations	so as to take care whereas sustainable development is using resources to sustain our lives without compromising future needs.	natural resources	
A5: an attempt to equip learners with the knowledge for sustainable use of natural resources	B5: it refers to mankind's quest to know the origins of the earth and current process controlling it	C5: process of reminding people about better ways of interacting with the environment	D5: is the knowledge about the socio-economic benefits we derive from the environment	A5: both equip people with the knowledge of conserving environment but environmental education comes first followed by sustainable development	B5: no clear response	C5: is the knowledge about utilization of resources in a way that enable future generation to benefit from it	D5: Environmental Education refers to the knowledge on using resources wisely without wastages
7. What are your views on learning environmental education in schools?				8. Are you likely to face problems in teaching issues as teachers?			
A1: environmental issues are of concern because they are sources of	B1: it equips students with adequate knowledge on how to suitably	C1: it should be practical to allow pragmatic learning at all levels	D1: it's important for human survival and people get knowledge for safe	A1: I have sufficient knowledge which I obtained through reading articles	B1: no because I experience environmental issues daily	C1: yes due to lack of understanding as a result in lack of experiment	D1: I might experience problems due to shortages of resources such as media and money to

livelihoods so depleting resources means destroying lives	manage the environment such as wildlife and water		keeping the environment			s and field trips to enhance pragmatic learning. EE is linked to other subjects it must be a standalone subject	fund field trips
A2: human beings rely on the environment and depleting resources mean destruction of lives	B2: it imparts knowledge to people on the dangers of having negative attitudes about the environment	C2: EE is important because it talks about the relationship between human beings and the environment	D2: people learn to appreciate their environment such as the importance of trees, water and soil	A2: I am well versed with environmental issues from the university	B2: No problem I am equipped with environmental knowledge by the university	C2: yes due to lack of modern approaches like GIS and remote sensing	D2: yes because at times it is difficult to vary teaching methods due to lack of resources such as finance and experts
A3: it is good because it enable future generations to have access to the resources because we will not overexploit resources	B3: it gives knowledge to individuals and communities on how to use environmental resources carefully and to be aware of environmental problems	C3: its important because it imparts knowledge about the environment to learners for example overgrazing, deforestation air pollution and soil erosion	D3: no response	A3: environmental education teaching lack practical aspect so it's a challenge	B3: no problem because I appreciate the value of the environment	C3: yes because some of the concepts are difficult for learners because it consists of scientific concepts which are difficult to interpret.	D3: yes because the subject is taught in theoretical way
A4: it equips people	B4: Environmental Education	C4: it equips learners	D4: Environmental Education	A4: I face no challenge	B4: there is a challenge	C4: yes because of a negative	D4: yes due to lack of resources

with the awareness on bad habits that may lead to environmental problems like flooding and siltation of rivers	must be a standalone subject divorced from geography that tackles environmental issues from early grades at school	with knowledge on the importance of the environment	helps pupils to be sensitive to the environment	s because students experience the same environmental problems	that learning process is more theoretical and there is a need for practical exposure on real environmental issues	attitudes towards practical exercises by some learners	such as weather stations in schools, lack of field trips and exhibitions are also major challenges
A5: it teaches students about disastrous environmental actions	B5: it must be a different subject that teaches students environmental issues and how they can influence to their communities	C5: its important in teaching people on how to conserve their environment	D5: it stresses the relationship that exist between man and his environment	A5: I face no challenges because in our daily life we experience environmental problems so teachers and pupils have practical knowledge	B5: Environmental Education rely on local situations and videos should be incorporated in learning global situations	C5: yes due to lack of financial resources for field visits	D5: yes lack of current technology such as GIS and remote sensing instruments for mapping
9. Why should environmental education be part of Geography and not any other secondary subjects?				10. What can be done to enhance your overall understanding in teaching EE?			
A1: ecological issues are scientific and will fit in geography curriculum well than in	B1: geography enables one to understand phenomena and adaptation to	C1: geography provide knowledge on how human beings co-exist with nature such as living	D1: ecological concepts interact with human beings hence it should be part of geography	A1: teach students to write journal articles in order to spread environmental knowledge	B1: engage students in actual exploitation of scenarios such as field trips	C1: teach students how to write projects on environmental issues, field trips and	D1: institutions must bring environmental experts and emphasis must be put on field trips, visiting institutions like EMA and media

other disciplines	prevailing changes	with animals without disturbing their ecosystem				experiments need to be conducted	must be used effectively
A2: issues to do with the conservation and preservation of the environment are geographic in nature	B2: no response	C2: the two are related because geography looks at how man interact with environment	D2: ecological concepts are part of geography for example ecosystem management expose sustainable management practices	A2: inclusion of projects like gully filling and tree planting in geography	B2: by doing group discussion and presentations for example pupils discuss how to use resources positively and dangers of negative attitudes towards the environment	C2: by attending workshops on environmental education and field trips	D2: preservice teachers must attend workshops on environmental issues, university can higher experts from EMA
A3: ecological concepts pertain to the relationship between man and the environment and can only be part of geography	B3: no response	C3: geography teacher goes in the environment to understand natural processes	D3: it helps people to appreciate their environment	A3: the use of modern technology such as projectors to show environmental issues enhance learning of environmental education	B3: there is need to expose students to areas of concern for example where deforestation and pollution are taking place	C3: by consulting a lot of literature on environmental issues	D3: university must fund field trips for students
A4: geography is the scientific study of the earth (flora and	B4: environmental and ecological concepts must be separate	C4: there is a relationship since geography helps individual	D4: ecological concepts bring awareness to a lot of environment	A4: trips may enable students to have an in-depth understanding	B4: teachers must not rely on knowledge they acquire during training but	C4: by reading more journals	D4: need for widespread use of internet and videos

fauna) hence ecological concepts fall in geography curriculum	disciplines	to know ways of conserving the natural resources	environmental problems hence they are part of geography	teaching of environmental issues	must be retrained to update their knowledge, teachers must also use modern technology in teaching		
A5: because people acquire knowledge on how to preserve and live on safe environment	B5: geography entails the study of the environment and two disciplines must be separate	C5: Environmental Education helps the implementation of better ways of conserving the environment thus it fits well in geography	D5: ecological concepts are crucial in geography, they advocate for sustainable environmental problem and it conscientise men on how to positively relate with ecosystem	A5: use of media, projectors, videos and visiting institutions like EMA	B5: there is a need for students to have field trips to experience environmental issues like erosion and river process	C5: by field trips and visiting areas experiencing hazards	D5: need for practical approach when teaching geographical concepts

Summary of categories from the focus group interviews

Role of geography knowledge in my life

13 Categories emerged

1. Teaches me to conserve the environment
2. Help me to understand the earth's processes
3. Enlightens me on various interactions that exist on the global space for example the relationship between population growth and food supply
4. enable me to have knowledge about the environment

5. it provides knowledge and skills in teaching EE and promotes knowledge on sustainable development
6. enabled me to understand the various components of the environment such as vegetation and buildings
7. help me to understand spatial location of towns and cities
8. help me to understand the distribution of phenomena on earth and its importance to humanity such as rivers and mountains
9. enable me to understand climate and weather patterns and the importance of the environment to humans
10. Helped me to understand geographic phenomena such as use of scientific methods like observation and making sound conclusions
11. Helps me to understand migration patterns and their causes and an understanding of climate and soils.
12. Enables me to understand population dynamics and how to be sensitive to the environment
13. conscientise me about the environment such as where and why resources are distributed the way they are

Understanding of the environment

6 categories emerged

1. a set of social, economic, physical and biological components that surround humans
2. Space inhabited by living and non-living organisms supporting each other for example rocks produce soil to sustain vegetation
3. Naturals such as flora and fauna and the man made landscape
4. all features on earth and their interaction with humans
5. all landscape surrounding us where people get a living
6. area where specie like animals and plants interact

Reasons for studying the environment

12 categories emerged

1. to understand the relationship between man and his surroundings
2. to have better understanding of it and to know ways of improving and conserving it
3. to develop awareness towards the environment
4. to have knowledge on species and why they occupy certain areas
5. to know the activities that can harm and acquiring of new skills to address urgent environmental challenges

6. enables us to be aware of the dangers of causing environmental degradation and ways of avoiding it
7. know the ways of conserving finite and infinite resources with consideration of future generation's needs
8. to appreciate the role of each component found within the environment for example the role of trees and soil
9. design conservative measures which reduce man's degradation of the environment
10. to gain knowledge of environmental resources such as trees and minerals and the benefits we derive from them
11. to reduce population pressure on resources and reduce pollution
12. to appreciate the natural landscape

Concern for the environment

14 categories emerged

1. The earth has limited resources
2. plants and animal needs to exist like humans also
3. humans severely abuse the environment
4. to reduce the selfish of humans on human-nature interaction
5. to help humans to adapt themselves to the conditions of nature and natural world
6. human activities makes the earth uninhabitable
7. in order to identify environmental problems and control and manage them
8. manage resources for sustainability
9. humans were meant to regulate over the nature
10. reduction in natural resources as a result in overpopulation
11. human beings gain a lot from the environment
12. Environmental issues are of concern because humans emit pollution in the atmosphere causing climate change hence there is a need for climate change mitigation strategies
13. Environmental issues affect me for example soil erosion cause siltation of rivers which result in drying up of dams.
14. humans should be rational when dealing with environmental issues like pollution, erosion and deforestation to avoid environmental degradation

Two themes Emerged

Definition of Environmental Education

11 categories emerged

1. is the learning process that increase knowledge and awareness about the environment
2. the study of negative and positive things that exist in the environment and ways of coping with them
3. it brings sustainable development since resources are utilized wisely
4. is the study of the area surround us as human beings such as landscape, flora and fauna
5. it refers to mankind's quest to know the origins of the earth and current process controlling it
6. the lifelong process of appreciating the interrelationship between human beings and nature and promotion of environmental behavior that promotes sustainability and application of knowledge from different disciplines to study environment
7. process of reminding people about better ways of interacting with the environment
8. is education about the safe keeping of the environment for future use
9. refers to education on species interaction in the ecosystem
10. it is about studying what is in our environment
11. is the knowledge about the socio-economic benefits we derive from the environment

Environmental Education in the context of Sustainable Development

11 categories emerged

1. both educate people about the environment but environmental education comes first followed by sustainable development
2. both protect and conserve the environment for future use in mind
3. deals with the rationale use of resources at minimum cost
4. the two brings development to the country since resources are used wisely with future generation in mind
5. Environmental Education educates people on the importance of the surrounding landscape
6. Environmental Education teaches people to use resources wisely and carefully in order to preserve them for future
7. if people are educated about the environment they avoid activities that may lead to the extinction species for the benefit of future generation
8. is a way of conserving natural resources
9. both consider the needs of future generations when using resources
10. the impartation of knowledge on how best to use our environment
11. Environmental education gives us awareness on issues like erosion and siltation and on how to reduce them

Reasons for learning/views environmental education in schools

14 categories emerged

1. environmental issues are of concern because they are sources of livelihoods so depleting resources means destroying lives
2. it is good because it enable future generations to have access to the resources because we will not overexploit resources
3. it teaches students about disastrous environment actions
4. it equips students with adequate knowledge on how to suitably manage the environment such as wildlife and water
5. it imparts knowledge to people on the dangers of having negative attitudes about the environment
6. it gives knowledge to individuals and communities on how to use environmental resources carefully and to be aware of environmental problems
7. Environmental Education must be a standalone subject divorced from geography that tackles environmental issues from early grades at school
8. It's important because it imparts knowledge about the environment to learners for example overgrazing, deforestation air pollution and soil erosion
9. it should be practical to allow pragmatic learning at all levels
10. Environmental Education is important because it talks about the relationship between human beings and the environment
11. it's important for human survival and people get knowledge for safe keeping the environment
12. people learn to appreciate their environment such as the importance of trees, water and soil
13. Environmental Education helps pupils to be sensitive to the environment
14. it stresses the relationship that exist between man and his environment

Possible problems in teaching environmental issues

13 categories emerged

1. I have sufficient knowledge which I obtained through reading articles
2. I am well versed with environmental issues from the university
3. I face no challenges because students experience same environmental problems
4. No because teachers and pupils have practical knowledge
5. no because I experience environmental issues daily
6. no problem because I appreciate the value of the environment
7. Environmental Education rely on local situations and videos should be incorporated in learning global situations
8. Yes due to lack of understanding as a result in lack of experiments and field trips to enhance pragmatic learning. EE is linked to other subjects it must be a standalone subject

9. yes due to lack of modern approaches like GIS and remote sensing
10. Yes because some of the concepts are difficult for learners because it consists of scientific concepts which are difficult to interpret.
11. Yes because of a negative attitudes towards practical exercises by some learners
12. I might experience problems due to shortages of resources such as media and money to fund field trips
13. yes because at times it is difficult to vary teaching methods due to lack of resources such as finance and experts

Reasons for Environmental Education be part of Geography and not any other subject

13 categories emerged

1. ecological issues are scientific and will fit in geography curriculum well than in other disciplines
2. issues to do with the conservation and preservation of the environment are geographic in nature
3. ecological concepts pertain to the relationship between man and the environment and can only be part of geography
4. geography enables one to understand phenomena and adaptation to prevailing changes
5. geography provide knowledge on how human beings co-exist with nature such as living with animals without disturbing their ecosystem
6. ecological concepts interact with human beings hence it should be part of geography
7. the two are related because geography looks at how man interact with environment
8. geography teacher goes in the environment to understand natural processes
9. it helps people to appreciate their environment
10. geography is the scientific study of the earth (flora and fauna) hence ecological concepts fall in geography curriculum
11. environmental and ecological concepts must be separate disciplines
12. Environmental Education helps the implementation of better ways of conserving the environment thus it fits well in geography
13. it conscientise men on how to positively relate with ecosystem

Measures to enhance teachers' overall understanding in the teaching of Environmental Education

11 categories emerged

1. teach students to write journal articles in order to spread environmental knowledge
2. inclusion of projects like gully filling and tree planting in geography
3. the use of modern technology such as projectors to show environmental issues enhance learning of environmental education

4. engage students in actual exploitation of scenarios such as field trips
5. by doing group discussion and presentations for example pupils discuss how to use resources positively and dangers of negative attitudes towards the environment
6. by consulting a lot of literature on environmental issues
7. institutions must bring environmental experts and emphasis must be put on field trips, visiting institutions like EMA and media must be used effectively
8. preservice teachers must attend workshops on environmental issues, university can higher experts from EMA
9. teachers must not rely on knowledge they acquire during training but must be retrained to update their knowledge, teachers must also use modern technology in teaching
10. need for widespread use of internet and videos
11. need for practical approach when teaching geographical concepts

On views of teaching and learning of EE in schools PSTs are of the view that:-

- EE gives knowledge and awareness of the environment (17)
- For future generations (1)
- Subject should be practical (1)

The above are developed by:-

- By avoiding depleting resources (16)
- By giving adequate knowledge on the environment (2)
- Influence communities (1)

This is development could be for:-

- Proper management of the environment in order to support life (17)

By developing better understanding of the environment (3)

8. Are you likely to face problems in teaching environmental issues as teachers?			
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On whether pre-service Geography teachers would face problems in the teaching of EE, they came out with these:-

- The need for sufficient knowledge (1)
 - The need for motivation (1)
 - The need for experience in teaching (1)
 - Too theoretical knowledge/ teaching is a problem (4)
 - Students need global exposure (1)
 - The need for modern approaches to the teaching of Geography (2)
 - At times presence of scientific vocabulary in Geography (1)
 - The need to develop correct attitudes (1)
 - Financial constraints (1)
 - Shortage of resources (1)
-

•

These are forged through:-

- **Getting environmental knowledge from reading (1)**
- **Teaching without practical (2)**
- **Both teachers and learners need to experience environmental problems practically (1)**
- **Use of videos should be part of learning (1)**
- **Lack of experiments, field trips, lack of link of EE and other subjects (1)**
- **The teaching of GIS and Remote sensing (2)**
- **EE consists of scientific terms (1)**
- **Negative attitudes towards practical excises (1)**
- **Financial constraints limit field trips (1)**
- **Shortage of resources (4)**

All these can be done for:-

- **Better understanding (15)**

Lack of knowledge by the teacher (4)

Yes = 16

No= 4

Reasons for Yes

- **Pre- service Geography teachers need adequate knowledge at university level in order to be able to teach EE**
- **Lack of sufficient knowledge would affect how teachers operationalize their teaching that includes EE**
- **Little practical teaching leads to theorizing what is supposed to be practical lessons in Geography and equal affects EE**
- **Need for practical Geography lessons where EE is taught especially attending to environmental challenges society is currently facing**
- **The use of modern approaches such as internet with appropriate software, videos, field trips would enhance the teacher's knowledge base in Geography and EE that would positively contributes towards effective teaching and appreciation of environmental problems**
- **Scientific nature and language in Geography may affect their syllabus interpretation and hence teaching. There is need to explain the science nature behind Geography concepts to truly empower the teacher**
- **Positive attitudes are important towards Geography concepts that includes EE, this would enable teachers to tackle EE issues effectively**
- **Schools are poorly resourced financially, which would affect their curriculum implementation, Geography and EE included. Application of various teaching methods would be difficult under those circumstances. Again the use of field trips as a teaching method is being affected by financial constraints**
- **Lack of resources such as transport to undertake field trips, time constraints, and manpower shortage among many would make curriculum implementation difficult. Overall, lack of resources affects the quality of instructions. Even diversifying on teaching methods is resource dependent such as acquisition of teaching materials.**
- **Central to modern technology is the teaching of GIS and remote sensing which are difficult if schools do not have the human and material resource base for effective teaching.**

Reasons for NO-

- Lack of requisite motivation on the part of the teacher and students affects their attitudes towards Geography and EE.
- Most pre-service teachers may lack experience and awareness in general to internalize the need to teach environmental problems. Most students are part of the larger society who do not appreciate the effects of living or working in poor environments
- Pre- service teachers have to have sufficient knowledge (understanding) that would lead to positive attitudes and positively affects environmental behavior

Understanding Positive Attitudes >>>>> Responsible Environmental behavior

- Lack of global exposure to environmental trends makes teaching localized that would negatively affects attitudes and subsequently behaviour

Why EE be part of Geography and not any other subject, PSTs had these:-

- Ecology is a science (12)
- Separate ecological and environmental issues (2)
- Help individuals (1)
- Geography to a standalone (1)
- Geography teacher travels widely (1)
- Acquire knowledge (2)

How the above can be achieved:-

- Geography explains human- environmental interactions (18)
- Divorce them (1)

The above can be justified because Geography does these:-

- Enables man to use resources (18)
- Can be taught separately (1)

10. What can be done to enhance your overall understanding in teaching EE?			
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On what can be done to enhance teachers overall understanding in the teaching of EE, Geography pre- service teachers had this to say:-

- Writing journal articles/ reading literature (3)
- Hand-on projects (3)
- Use of modern technology/ internet (2)
- The use of field trips (7)
- Micro- teaching (1)
- Workshops (2)
- In- servicing teachers (1)
- Hiring of resource persons (1)

These can be forged through:-

- **Journal articles/ magazines/pamphlets (3)**
- **Gully filling and tree planting (3)**
- **Use of projectors (2)**
- **Trips in the local environment (1)**
- **Workshops (1)**
- **use of modern technology (2)**
- **Hiring discipline specialists (1)**
- **Writing research projects (1)**
- **Marrying theory and practice (1)**
- **Depicting natural hazards and disasters (1)**
- **Field trips, experiments, field practice (10)**

The above is done to:-

- **Spread environmental knowledge (17)**
- **To rehabilitate the environment (1)**
- **To depict environmental issues (1)**
- **Make learning more practical and experiential in nature (1)**

Appendix 9 : Editing certificate

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EDITING CERTIFICATE

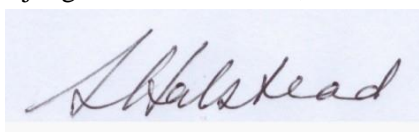
NAME: Daniel Gamira,

AFFILIATION: School of Education, University of KwaZulu-Natal

Draft PhD thesis (original title): *An exploration of pre-service Geography teachers' understanding and learning of Environmental Education at Lowveld University in Zimbabwe*

I confirm that I have edited this draft thesis for grammar and appropriate use of academic language. I have also attempted to improve the flow of the student's writing and make it more succinct. Where the student's meaning was not clear I have made suggestions about how to reword the material. I have made suggestions about the structure of his argument, leaving him to institute the changes as he wished. I reformatted a table as an example. I made minor corrections to, or suggestions about, the formatting of the list of references in accordance with academic conventions. I have highlighted where in-text citations did not correspond to the reference list; I have not cross-checked with the original publications.

As an independent educational consultant, one of my specialisations is editing academic documents. I am a native English speaker. I obtained a BSc at the University of Natal, with chemistry and applied mathematics majors. After graduation, I was a Research Officer in the Ministry of Roads and Road Traffic in, as was then, Rhodesia. My duties included writing reports and editing those for my colleagues. Some years later I entered the teaching profession and studied with UNISA for a postgraduate Higher Education Diploma, achieving a distinction for the English language module. After 20 years teaching at high school, I took up an academic position at the University of KwaZulu-Natal, where I completed an M.Sc. in chemistry education and wrote several research articles. Since retirement seven years ago, I have edited many academic papers, theses and dissertations, several of which were judged to be *cum laude*, and one of which required no alterations from the examiners.



Sheelagh Edith Halstead 6th January 2019

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